USDA
United States Department of Agriculture

Aerial Forest Insect and Disease Detection Surveys
in Oregon and Washington
1947-2016

The Survey

USDA Forest Service
Pacific Northwest Region
State and Private Forestry
Forest Health Protection
Portland, Oregon
R6-FHP-GTR-0302
September 2016

for the greatest good

Cover image: *Reproduced by Stevie Ruda from the cover of J.F. Wear and W.J. Buckhorn's 1955 manual,* Organization and Conduct of Forest Insect Aerial Surveys in Oregon and Washington.

Pesticides used improperly can be injurious to humans, animals, and plants. Follow the directions and heed all precautions on the labels. Store pesticides in original containers under lock and key--out of the reach of children and animals--and away from food and feed. Apply pesticides so that they do not endanger humans, livestock, crops, beneficial insects, fish, and wildlife. Do not apply pesticides when there is danger of drift, when honey bees or other pollinating insects are visiting plants, or in ways that may contaminate water or leave illegal residues. Avoid prolonged inhalation of pesticide sprays or dusts; wear protective clothing and equipment if specified on the container. If your hands become contaminated with a pesticide, do not eat or drink until you have washed. In case a pesticide is swallowed or gets in the eyes, follow the first-aid treatment given on the label, and get prompt medical attention. If a pesticide is spilled on your skin or clothing, remove clothing immediately and wash skin thoroughly. Do not clean spray equipment or dump excess spray material near ponds, streams, or wells. Because it is difficult to remove all traces of herbicides from equipment, do not use the same equipment for insecticides or fungicides that you use for herbicides. Dispose of empty pesticide containers promptly. Have them buried at a sanitary land-fill dump, or crush and bury them in a level, isolated place.

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Compiled by Julie Johnson

A limited special print edition was published in September 2016.
This updated digital edition was published in December 2016.

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Preface

In fall 2016, 70 years of aerial insect and disease detection surveys will be complete in Oregon and Washington. A 70 year celebration will be held in Portland in November 2016. This report was prepared for this event. It documents the people and events behind the Pacific Northwest geospatial dataset. It follows the federal program through its many organizational moves within USDA and is compiled chronologically for cross-referencing with the dataset. Some information is repeated in multiple places for ease of use.

A sequel report will document codes, timing of surveys, areas flown (when and why), evolving technologies, map bases, data automation and data summaries; its content will more closely resemble traditional metadata.

Throughout our years with the Region 6 aerial survey program, it was important to both Keith Sprengel (aerial surveyor 1992-2013; aerial survey program manager 2006-2013) and me (GIS data manager 1991-2013) to assemble the details of the history of the survey. While a focused effort proved to be far too large to undertake in addition to our regular jobs, we both tucked away information along the way for 'someday'.

In 2009, when the Corvallis Forestry Sciences Lab was disposing of old files, they invited Keith to go through them. Keith invited Mike McWilliams (Oregon Department of Forestry aerial surveyor 1995-2013), Ben Smith (aerial surveyor, 2002-2013; aerial survey program manager 2014-present), and me to join him.

Among other treasures, Keith discovered Douglas-fir beetle maps from the 1952 survey that helped fill holes in our historic geospatial dataset, and I rescued two copies of *Barkbeetle Enemies of California* (1935) and an original copy of Harry Burke's 1946, *My Recollections of the First Years in Forest Entomology* (Figure 1).

Figure 1. *Left to right: Mike McWilliams, Julie Johnson, and Keith Sprengel with historic treasures found at the Corvallis Forestry Sciences Lab in 2009. Photo by Benjamin Smith.*

I was delighted to later find that Boyd E. Wickman had published Burke's work (Burke 1990; Wickman 2005). Wickman's historical reports, and others by Malcolm M. Furniss and the Western Forest Insect Work Conference history committee are referenced extensively in this report.

Many other referenced memos and reports are unpublished and only available hardcopy in the R6 aerial survey program files. A vast collection of R6 grey literature is being catalogued, scanned, and digitally-archived at the National Forest Service Library by R6 entomologist Beth Willhite and librarian Lisa Stringfield-Prescott. When their project is complete, a much larger collection than what is presented here will be available.

Most of the material is necessarily presented through a federal lens. Time, budget, and travel restrictions limited my access to state and private cooperators' physical materials and many other special collections that hold numerous additional details.

My initial research for this project started in 2015 while working for Susan Hummel in Research (2013-2015). My office in the Gus Solomon Courthouse was one floor above the original Bureau of Entomology office Room 445 where the survey and control staff were housed from 1933-1954. Room 445 was empty, so I visited it often, imagining the early years and events, as the aerial survey came into being…

Julie Johnson
June 13, 2016
Portland, Oregon

Acknowledgements

The foundation of this report is based on Keith Sprengel's documentation and much of the research he conducted to prepare presentations for the 50 and 60 year aerial survey celebration, but all errors are mine.

I am extremely grateful to the following people for their time, resources, advice, technical reviews, subject-matter-expertise, and assistance:

Bob Backman, Lincoln Bramwell, David Bridgwater, Paul Buffam, Christine Buhl, Carin Clay, Bill Ciesla, Norm Cimon, Doug Daoust, Aleksandar Dozic, Donald Ewing, Sarah Flick, Rob Flowers, Malcolm Furniss, David Graham, Tommy Gregg, Mike Hamel, Zack Heath, Justin Hof, Bruce Hostetler, Susan Hummel, LeRoy Kline, Glenn Kohler, Roy Magelssen, Jeff Mai, Tim McConnell, Mike McWilliams, Jeff Moore, Steve Morse, Danny Norlander, Max Ollieu, Peter Orr, Dave Overhulser, David Powell, Iral Ragenovich, Amy Ramsey, Karen Ripley, Stevie Ruda, Charles Sartwell, Bob Schroeter, Benjamin Smith, Lia Spiegel, Keith Sprengel, Lisa Stringfield-Prescott, Torolf Torgerson, Suzanne Wiley, Beth Willhite, and Wyatt Williams.

I am especially indebted to Malcolm Furniss for the historical archives that he maintains on behalf of the Western Forest Insect Work Conference and for his critical reviews, guidance, and kind advice throughout this process.

A warm thank you to Craig Creel and Ray Touchstone for writing accommodations, access to historic files, and hospitality at the 1938 Cascade Head Experimental Forest office.

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Abstract

The USDA Forest Service, State and Private Forestry, Forest Health Protection program is charged with assessing and reporting the health of forested lands in the United States every year. In the Pacific Northwest, annual aerial insect and disease detection surveys have been conducted systematically over the forests of Oregon and Washington since 1947. This survey is made cooperatively between the USDA Forest Service, the Oregon State Department of Forestry, and the Washington State Department of Natural Resources. Overview surveys are generally flown from June-September. Human aerial observation continues to be the fastest and most economical means to detect, map, and report forest disturbances to land managers. The resulting data, maps, and summary reports are compiled and distributed to federal, state, and private land managers. Draft data from these observations are often delivered for same-day use on the ground. Annual geospatial data and summary reports are also submitted to the Forest Health Technology Enterprise Team in Fort Collins, Colorado where they are combined with information from other regions for national forest health reporting. With the completion of the 2016 aerial survey, 70 consecutive years of geospatial data are available for Oregon and Washington. This report is the first of two; together they will provide complete metadata to accompany the geospatial dataset. This report, *The Survey*, documents the people, aircraft, organizations, legal authorities, aviation, safety, and other historic events leading up to, and through, surveys conducted in Oregon and Washington from 1947-2016. Part 2 – *The Data* will further explore the data, track the evolution of causal agent codes, map bases, evolving technologies, data automation, and reporting mechanisms. While the focus for both reports is primarily Oregon and Washington (spatially) and 1947-2016 (temporally), some years and events that don't comply with these stated extents are included for greater context.

Keywords: Aerial survey; detection survey; aerial reconnaissance; sketch mapping; sketchmapping; forest insect; forest disease; forest disturbance; forest health; Oregon; Washington; Pacific Northwest; Oregon State Department of Forestry; Washington State Department of Natural Resources; USDA Forest Service; Forest Health Protection; personnel; aircraft; aviation; safety.

To access all historic and current Oregon and Washington aerial insect and disease survey program information and geospatial data, please visit: http://www.fs.usda.gov/detail/r6/forest-grasslandhealth/insects-diseases/

See Appendix 1 for a list of annual reports summarizing these data.

Acronyms

ADS –	Aerial Detection Survey
AFF –	Automated Flight Following
AGL –	Above Ground Level
ARA –	Agricultural Research Administration
ARS –	Agricultural Research Service
AS2M –	Aerial Survey and Aviation Safety Management training
ASPM –	Aerial Survey Program Manager
ASWG –	Aerial Survey Working Group
ATC –	Air Traffic Control
BEPQ –	Bureau of Entomology and Plant Quarantine
BoE –	Bureau of Entomology
B.t. –	*Bacillus thuringiensis* biological insecticide
C&C –	Calibration and Conformity training
CAA –	Civil Aeronautics Authority (1938-1958)
CAB –	Civil Aeronautics Board (1940-1958)
CCC –	Civilian Conservation Corps
CFAA –	Cooperative Forestry Assistance Act (1978)
CWN –	Call when needed (aircraft)
DASM –	Digitally assisted sketch mapping system
DDT –	Dichlorodiphenyltrichloroethane insecticide
ECW –	Emergency Conservation Work
ERA –	Emergency Relief Act
FAA –	Federal Aviation Administration (1958-Present)
FAM –	Fire and Aviation Management (USFS)
FHTET –	Forest Health Technology Enterprise Team
FHP –	Forest Health Protection
FID –	Forest Insects and Diseases
FIDM –	Forest Insect and Disease Management
FII –	Forest Insect Investigations
FPCA –	Forest Pest Control Act (1947)
FPM –	Forest Pest Management
FS –	USDA Forest Service
FSH –	Forest Service Handbook
FSM –	Forest Service Manual
IAMS –	Interagency Aviation Management and Safety
IAT –	Interagency Aviation Training
ICS –	Incident Command System
IDC –	Insect and Disease Control
IDM –	Insect and Disease Management

MAG –	Methods Application Group
MSL –	Mean sea level
NEPA –	National Environmental Policy Act
NFF –	National Flight Following
NFS –	National Forest Systems (a branch of the USFS)
NFPAC –	Northwest Forest Pest Action Council
NM –	Nautical mile
NR –	Natural Resources
ODA –	Oregon Department of Agriculture
ODF –	Oregon State Department of Forestry
OFIC –	Oregon Forest Industries Council
OSBF –	Oregon State Board of Forestry
PAC –	Pest Action Council
PDX –	Portland International Airport
PNFRES –	Pacific Northwest Forest and Range Experiment Station
PNW –	Pacific Northwest
PTB –	Position Task Book
R6 –	Region 6 - Pacific Northwest Region, Oregon and Washington, USFS
RES –	Research and Development branch (USFS)
RAG –	Regional Aviation Group
RAO –	Regional Aviation Officer
RASM –	Regional Aviation Safety Manager
RO –	Regional Office (USFS)
RSAC –	Remote Sensing and Applications Center
SNC -	Swiss Needle Cast
SOD –	Sudden Oak Death
SONC –	Southern-Oregon Northern-California (control project – 1922-1924)
SPF –	State and Private Forestry (a branch of the USFS)
STOL –	Short Take-off and Landing
TFR –	Temporary Flight Restriction
USDA –	United States Department of Agriculture
USDI –	Unites States Department of the Interior
USFS –	USDA Forest Service
USFWS –	USDI Fish and Wildlife Service
WDFW –	Washington State Department of Fish and Wildlife
WDNR –	Washington State Department of Natural Resources
WFCA –	Western Forestry and Conservation Association
WFIWC –	Western Forest Insect Work Conference
WO –	Washington Office (Forest Service)

Figure 2. *Aerial insect and disease detection survey geospatial data, 1947-2015.[1] Annual layers = light grey. Black areas represent 30-40 years of cumulative activity. USFS R6 Aerial Survey Program.*

[1]The 2016 survey season was underway as this manuscript went to publishing.

Chapter 1
Introduction

The primary purpose of this report is to provide a narrative historical document as contextual metadata to accompany the 70 year (1947-2016) Oregon and Washington geospatial aerial insect and disease detection dataset. Contextual metadata for this purpose is defined as:

> *The characteristics of digital objects that must be preserved over time in order to ensure the continued accessibility, usability, and meaning of the objects, and their capacity to be accepted as evidence of what they purport to record (Grace et. al 2009, in Faniel and Yakel 2011)*

With the completion of the 2016 survey, the geodatabase will contain approximately 900,000 polygons (Figure 2). Mapped over the course of 70 years, many factors surrounding the collection of these data have changed through time. These elements include: political, cultural, aviation and safety policies, legal, and biological reasons for conducting the aerial surveys, as well as the agencies, people, and supporting organizations who make the surveys. The details of these combined factors create a rich program history. This report compiles some of the highlights into a historic record.

Because the geospatial dataset is annual, most sections are presented in chronological order for cross-referencing. The inclusion of full-text excerpts provides original source material for ease of access, referencing, and further use.

This report (*The Survey*) documents who, when, where, why, and the aircraft portion of 'how'. The next report (*The Data*) will explore the data recorded each year and track the evolution and importance of causal agent codes, map bases, evolving technologies, data automation techniques, and data summaries. *The Data* will more closely align with traditional geospatial metadata, but will also be presented in a historical, chronological narrative format.

While the focus for both reports is primarily Oregon and Washington (spatially) and 1947-2016 (temporally), there are additional years and events included, to provide greater context for the survey story.

1.1 An overview of Oregon and Washington aerial insect and disease detection surveys

In the states of Oregon and Washington, forested lands are annually surveyed by air to determine and document current-year forest tree damage. This systematic, mostly grid-based, aerial detection survey has been conducted since 1947 for the benefit of all state, private, and federal land managers. A small group of committed surveyors from the U.S. Department of Agriculture (USDA), U.S. Forest Service (USFS), the Oregon State Department of Forestry (ODF), and the Washington State Department of Natural Resources (WDNR) cooperatively accomplish the survey each summer; 2016 marks the completion of 70 continuous surveys.

Oregon has approximately 30 million acres and Washington approximately 22.4 million acres of forestland; these combined 52 million acres of forested lands are systematically surveyed from a fixed wing aircraft each year. High-winged aircraft with good visibility, and capable of flying at relatively slow speeds, are best for conducting surveys (Johnson and Wittwer 2008), and are generally flown at 1,000-2,500 feet above ground level (AGL) at a speed of 90-120 knots. When surveys are flown on a 4 mile grid, each surveyor looks out one side of the plane at a distance of approximately two miles. At an average speed of 100 knots, approximately four square miles/minute are evaluated by each aerial observer. The "goal" is to assess and record only current year damage.

Overview surveys are generally conducted from early June through September during good weather; this is when most important forest change event 'aerial signatures' are visible from the air. To determine causes, surveyors are trained to recognize aerially-observable signatures including color, pattern, and texture. Other signatures, more visible at other times during the year, require specially-timed surveys to map these events.[2]

In Region 6, up to three causal agent(s)/polygon may be detected and classified by observers; polygons showing the extent of damage are delineated by hand. Attributes indicating host tree species, damaging causal agents, and associated loss, including relative severity or number of trees affected, are assigned to each polygon. The primary intent of the survey is to record insect and, to a lesser extent, disease activity; however other causes of tree damage and mortality (i.e. fire, wind, hail, bear, etc.) are also mapped.

From 1947-2002, paper maps at scales ranging from 1:253,440 (one-quarter inch to the mile), 1:100,000 (30' x 60' USGS quad sheets), and 1:126,720 (one-half inch to the mile) were used in the airplane to record damage polygons. In 1995 R6 initiated a request for the Forest Health Technology Enterprise Team (FHTET) and the Missoula Technology Development Center to explore digital sketch mapping systems.[3] In 2001 the region began experimenting with a customized version of GeoLink's digitally assisted sketch mapping (DASM) system. Since 2003, 100% of the R6 geospatial insect and disease data have been recorded with DASMs (see Schrader 2001).

DASM, with GPS-referenced digital map bases and custom imagery, has increased the locational accuracy of damage polygon placement in R6. The system allows for real-time, in-plane geospatial data creation and same-day draft[4] digital map distribution.[5]

[2]For example, Swiss needle cast on Douglas-fir in the Oregon Coast Range is most visible from the air during April and May before budburst. Sponsored by the Swiss Needle Cast Cooperative, a special survey has been flown by the State of Oregon since 1996 to capture this event. To learn more about the cooperative see: http://sncc.forestry.oregonstate.edu/ (accessed March 2016).

[3]Iral Ragenovich helped direct the first $10,000 for this project to Harold Thistle and Jack Barry at the Missoula Technology Development Center from Special Technology Development Project funds (personal communication with Iral, April 12, 2016).

[4]Only digital draft survey maps are immediately made available; the processed geospatial dataset is only made available for distribution at the end of the survey season after it has been finalized each fall.

[5]In the 1970s, Tommy Gregg (USDA FS aerial surveyor 1969-1979) recalled landing on airstrips immediately after flying a forest to show the maps to the local land managers, because the compiled maps and data might not be available until after the field season (personal communication 9/25/2015); Bill Ciesla said this was still happening 1988-1990 (personal communication May 6, 2016).

At the end of each season, October-December, geospatial data are finalized and compiled by the USFS and shared with state cooperators. Final maps, reports, and geospatial data are distributed to state, private, and federal land managers throughout Oregon and Washington.

Data are also submitted to the Forest Health Technology Enterprise Team (FHTET) in Fort Collins, CO, where they are combined with other regions' data for national mapping and reporting.[6]

The pioneering R6 aerial surveyors in 1947 were John Wear (forester-pilot) and Walter J. Buckhorn (entomologist-surveyor). The parameters and guidelines they developed to conduct aerial insect and disease detection surveys are well-documented in their 1955 aerial survey manual *Organization and Conduct of Forest Insect Aerial Surveys in Oregon and Washington* (Wear and Buckhorn 1955). While many of the 1955 guidelines still apply today, in 2000 Timothy J. McConnell, Erik W. Johnson, and Barbara Burns wrote an update, *A Guide to Conducting Aerial Sketchmap Surveys* (McConnell, Johnson, and Burns 2000).

1.2 Aerial vs. ground surveys

Figure 3. *February 1935. Scouting a western pine beetle infested area. From a lookout point, the spotter counts fading, sorrel, and red trees and notes their locations on a map. Photo: Salman, Miller, and Patterson. Source: Barkbeetle Enemies of California Forests. Prepared by the BEPQ in cooperation with the State Emergency Relief Administration – Project 3F-2-302 and Emergency Educational Program. Berkeley, CA. Hardcopy, R6 Aerial Survey Program files.*

[6]See Johnson and Wittwer 2008 for the Forest Health Monitoring program's use of the nationally compiled aerial survey data.

In many of the early accounts, no distinction was made between aerial and ground surveys. Prior to 1947, very few aerial surveys were conducted, so most references to 'surveys' in historic reports are ground surveys. A vast number of acres covered on the ground each year. But even when aerial detection flights began in 1947, ground survey data continued to supplement and refine aerially collected data on through the late 70s.

Two types of early ground surveys, intensive and extensive, were explained in a 1946 report by Walter J. Buckhorn of the Bureau of Entomology and Plant Quarantine:

> *During the fall of 1935 the first steps were taken to determine the severity and extent of the western pine beetle infestation in the ponderosa pine stands within and adjacent to the Umatilla National Forest. Since then surveys have been carried on annually except during 1945 when, due to the war, manpower was not available. These surveys have been carried on through the cooperative efforts of the Forest Service and the Bureau of Entomology and Plant Quarantine.*
>
> *From year to year the scope and character of the surveys has varied somewhat. During 1946 the survey was both intensive and extensive in character. The intensive phase, which consisted of a 100 percent cruise of all insect-caused losses on four semi-permanent 320-acre plots, was carried on during the period of July 31 to August 22 by a Forest Service crew consisting of Messrs. Donald C. Wheat, Fred Reiter, and Gould J. Hoyt, crew leader. The extensive phase of the survey consist of an observational reconnaissance of all forest types. The stands were viewed from roads, trails, lookouts and other points of vantage [Figure 3]. The writer carried out this phase of the survey in addition to supervising the crew.*[7]

Figure 4. *Field bug crew. 1932. Left to right: W.J. Buckhorn, Lynch, F.P. Keen, Kapitke, Parr. USFS Portland Station Collection, PS-6003.*

From a 1958 *Insect and Disease Short Course* budworm discussion:

> **Survey needs:**
> *During epidemic cycles, comprehensive aerial and ground surveys are necessary to evaluate the needs for and the results of treating. In Oregon and Washington, experienced crews consisting of Forest Service and State Forestry*

[7]Buckhorn, W.J. 1946. Pine beetle survey of 1946 on the Umatilla National Forest. Bureau of Entomology and Plant Quarantine, Forest Insect Laboratory, Portland, Oregon. p.2.

Figure 5. *Walter J. Buckhorn (center) conducting training on the Wallowa-Whitman National Forest in 1960. Photo by Peter Orr. USFS Portland Station Collection, PS-2604.*

> *personnel. Aerial surveys are made as soon as possible after the feeding for the year is completed and while the reddish cast of the severed needles is conspicuous. Detailed ground checks are necessary to verify aerial survey findings as to the extent and intensity of damage. Cooperative ground surveys, involving many foresters, are often organized to delineate light budworm infestations not detectable from the air. Detailed procedures for ground surveys have been developed and are explained at training sessions when needed [Figure 5].[8]*

1.3 Aerial insect detection vs. control

Spraying or dusting trees for the control of forest insects is often interchangeably referenced as spray, suppression, treatment, or control projects.

In the early years, aerial detection surveys and aerial control operations were directly linked. A primary purpose for aerially-mapping outbreaks was to determine the extent and need for control operations. From Yuill and Eaton 1949:

> *The airplane has become a new weapon in the never-ending battle against destructive forest insects. As in military operations, it is bringing about radical changes in strategy. Aircraft are serving two purposes in this phase of forest protection: For detection surveys to locate serious insect outbreaks and for the application of insecticides to control dangerous infestations.[9]*

[8]Whiteside, J.M. 1958. Spruce budworm – a major defoliator regionwide. In: Insect and disease short course. Corvallis, OR: Oregon State University. Hardcopy, R6 aerial survey program files. Sandy, OR.

[9]Yuill, J.S.; Eaton, C.B. 1949. The airplane in forest-pest control. In: USDA Yearbook of Agriculture 1949. p.471.

These control operations were huge efforts, often involving multiple government agencies, private landowners; contractors, multiple aircraft, and 100s of people. This illustration is from Swingler[10] 1959:

Aerial Spraying:

Aerial spraying with insecticides is probably the most controversial phase of forest insect control work. More has been written and said, pro and con, about spraying and about its effect on plants, animals, fish, and man than on any other phase. In recent years the subject has received increasing attention from conservation-minded individuals and organizations.

We believe that this interest has been beneficial to forest conservation. It has helped focus attention on the destructiveness of forest insects and has helped stimulate the highest standard of performance on insect spraying projects. We welcome the continued interest of forest conservationists in aerial insect spraying and are glad to have their many suggestions. Because of this interest I would like to relate in detail the procedure followed by the United States Forest Service in aerial spraying.

We approach aerial spraying with our eyes wide open. It is a complex, hazardous undertaking that requires and receives painstaking preparation to insure safe, effective execution. And here is a fact not generally known: The preliminary phase of an aerial spraying operation may require months, whereas the operational phase may take only a few days.

During the preliminary phase, organizational charts are prepared, duties and responsibilities are assigned, and necessary training completed. Density of pre-spray insect populations are estimated in conjunction with larval development checks. Acreages needing treatment are determined and boundaries established. Contracts for aircraft and pesticides are let. Equipment and supplies are obtained and arrangements are made for housing, feeding, and transporting personnel. An effective communication system is planned and a rigid safety prescription developed for the operational phase. Contracts are made with landowners, necessary rights-of-way are obtained, airfields are constructed or leased. Advance public notices about the project are sent to all affected groups. Working relations are established with the Weather Bureau, Civil Aeronautics Administration, United States Fish and Wildlife Service, state fish and game departments, and other federal and state agencies. Suppression and performance standards are developed and precautions outlined for minimizing the hazards of insecticidal spraying to fish and wildlife. These and many other jobs comprise the all-important preparatory phase.

…

Pilots spray only when the air is calm, usually from 4:00 to 10:00 A.M., so there will be little drift of chemicals to a non-forest area. They shut off the spray when over crop lands. They turn it off when flying over water. They plan the spray so that it will not drift over water. They don't turn around over water.

The planes are calibrated to deliver the right amounts of spray and are checked frequently to assure that the application rate is correct. The pesticide is analyzed periodically to see that the formula remains the same. Pilots space their spray runs to avoid overlaps of the chemical when it lands on the treatment area.

Airplanes are kept in good mechanical condition so sprays will not have to be dumped as an emergency measure. Forest Service chartered observer plans and personnel are on constant duty during spray operations to see that the pesticide is being correctly applied to the designated areas and that all prescribed safe-guards are being followed.[11]

Often the same pilots who flew the aerial detection surveys, also flew the spray planes on control projects. Figures 6-11 show a few of the aircraft and pilots used on early control projects in the Pacific Northwest.

But the complete history of forest insect control projects in Oregon and Washington is a whole other story and a geospatial dataset unto itself. So, while references to a number of control operations are included in this report, documenting the extensive history is outside the scope of this effort.

[10]W.S. Swingler was Assistant Chief, U.S. Forest Service, 1959.

[11]Swingler, W.S. 1959. Keeping forest insects in their place. American Forests. 65(2):37-38, 42.

Figure 6. *WACO airplane, NR30164 (S-2), piloted by Bob Allison of Central Aircraft. Hemlock looper project, Clatsop County, Oregon. June 15, 1945. Photo by R.L. Furniss. USFS Portland Station Collection PS-664.*

Figure 7. *Loading Bob Allison's WACO aircraft with lead arsenate. Hemlock looper project, Clatsop County, Oregon. June 15, 1945. Photo by R.L. Furniss. USFS Portland Station Collection PS-671.*

Figure 8. *General view of loading area showing Stearmans and BTs. Spruce budworm project – Mt. Hood area. June 11, 1949. Photo by R.L. Furniss. USFS Portland Station Collection, PS-825.*

Figure 9. *Ace Flying Service, BT-19, NC 1207N, loaded with spray and ready for takeoff; Stearman in background. Spruce budworm project – Mt. Hood. June 19, 1949. Photo by C.F. Brockman. USFS Portland Station Collection, PS-845.*

Figure 10. *B-18 (back) and three Stearmans, with spray loading equipment. Spruce budworm project – Mt. Hood area. June 7, 1949. Photo by R. L. Furniss. USFS Portland Station Collection, PS-793.*

Figure 11. *Helicopter spraying on a western Oregon spruce budworm project. Rick Helicopter - N21H. March 1951. Photo by Oregon State Board of Forestry personnel. USFS Portland Station Collection, PS-922.*

1.4 Aerial signatures

Figure 12. *Hemlock looper damage. USFS R6 Aerial Survey Program Collection.*

Determining and classifying forest damage from the air is a specialized skill involving 'aerial signatures'. Unique aerial signatures are determined from host tree crown characteristics and the color and distribution of the damage. By combining these two factors, aerial surveyors are able to assign causal agents to damaged trees. Ciesla (2006, 2015) summarizes the two parameters as:

Characteristics of Host Trees

Forest insects and diseases tend to be host specific. Therefore, the ability to recognize tree species or at least species groups (e.g. true firs, white or soft pines) is essential to the recognition of forest damage signatures. By identifying from the air the tree species and forest types present in the areas surveyed, the observer can narrow the complex of potentially damaging agents that could be present. Recognition of tree species or species groups, both healthy and damaged, should be second nature to experienced aerial observers. Crown characteristics used to identify healthy tree species or species groups … are a combination of foliage color, crown form, crown margin, branch patterns and foliage texture…

Characteristics of the Damage

Characteristics that can be helpful in making an aerial diagnosis of the causal agent responsible for the damage include:

- *Color and texture of the affected crowns.*
- *Distribution of damage.*
- *Size of trees affected.*
- *Portion of the tree crown affected.*[12]

Recognizing, interpreting, and recording these aerial signatures means that the aerial observer must: detect change; determine extent, type, and severity; and digitally draw and attribute a polygon to represent the damage – all while continuously processing and recording approximately four square miles/second. Typically, aerial observers conduct two, 2-3 hour surveys each day.

1.5 Aircraft

Airplanes used for surveys in Oregon and Washington have varied through the years; some details and photos are contained in the chronological sections of this report. Ciesla offers a good overview of current-day survey aircraft characteristics:

High-wing, single-engine, fixed-wing aircraft have been the most widely used aircraft for aerial sketchmapping. These provide the ideal combination of visibility, maneuverability, ability to fly at relatively slow speeds (90-125 mph), and low cost. Four- and six-place aircraft are preferred to two-place aircraft because they can accommodate more aerial observers, maps, and other equipment needed for the surveys.

Aircraft performance is important, especially in the high, mountainous regions of the West. … in the West, the flying heights of survey aircraft may range between 4,000-9,000 feet above MSL, and occasionally, as high as 11,000 feet. During the summer months, when temperatures are higher, consideration of flight altitude is critical because of density altitude. This is an expression of the air density through which the aircraft flies and is dependent on temperature, relative humidity and altitude. For example, an airstrip may be at an elevation of 3,000 feet above MSL, but on a given day, its density altitude may be computed at 6,000 feet. This means that the aircraft can be expected to perform at 3,000 feet MSL as it would normally be expected to perform at 6,000 feet MSL (Klein et al. 1983).

…

In some of the more mountainous areas, twin-engine aircraft have been used with varying degrees of success. Examples include the Cessna 337 Skymaster, the Aero Commander 500 series, and the Partenavia P 68 series. Twin engines provide an added margin of safety, but the aircraft are also heavier, and must be flown at higher airspeeds to maintain air-worthiness. Because of its protruding engine cowl, the Cessna Skymaster has only fair forward visibility but excellent downward lateral visibility. A pressurized version of the Cessna Skymaster has smaller windows, which restrict visibility. The Aero Commander 500 series aircraft have excellent visibility from the front seats but poor visibility from the back seats. The Partenavia P-68 series are excellent aerial sketchmap aircraft, especially the model P-68 Observer, which can be equipped with a bubble front window. A number of aircraft suitable for aerial sketchmapping can be modified with a short takeoff and landing (STOL) conversion, which permits slower flying speeds and short airstrip operation. This conversion adds to the cost of the aircraft, however, and to operating costs.[13]

[12]Ciesla, W.M. 2006. Aerial signatures of forest insect and disease damage in the Western United States. FHTET-01-06. Forest Health Technology Enterprise Team, Fort Collins, CO. p. 3-6. See also, Ciesla et al. 2015.

[13]Ciesla, W.M. 2000. Remote sensing in Forest Health Protection. FHTET Report No. 00-03. Forest Health Technology Enterprise Team, Fort Collins, CO. p. 69-70.

1.6 The art of the sketch map

Figure 13. *Walter J. Buckhorn with sketch map board in the cockpit of a Cessna. USFS R6 Aerial Survey Program Collection.*

Interpreting aerial signatures and drawing areas with damage by hand on a paper map, digital map, aerial photograph, or satellite imagery is a remote sensing technique called sketch mapping (or sketchmapping). This technique is at the heart of the Oregon and Washington aerial detection survey's polygonal vector dataset and it has been used throughout all 70 years of data collection (Figures 13 and 14).

Sketch mapping is regarded both as a scientific data collection technique and an art form (Klein et al. 1983; McConnell, Johnson, and Burns 2000). A sketch map created during an aerial reconnaissance provides a landscape-level assessment of location, extent, and cause of forest damage that is detectable from the air. With information from these overview surveys, land managers can assess current conditions that often require further ground investigation and action.

Aerial sketch mapping is a technique that dates back to the Civil War. In 1861, John La Mountain, a Civil War aeronaut (Hennessy 1985) sketched a crude hand-drawn map of an enemy encampment from a balloon ~500 feet in the air and said this of his experience:

> *To the eye of the aeronaut—who can, by the knowledge his art affords him of the direction and depth of different strata of the atmosphere, sail directly over points impenetrable by … scouts …The country lies spread before him like a well-made map, with all its varieties of hill and valley, river and defile, distinctly defined, and with every fort, encampment, or rifle-pit within a range of many miles, manifest to observation.*[14]

The technique was enhanced in the early 1900s with airplanes. During an Army training exercise, on March 31, 1913, 2nd Lieutenants T.D.W. Milling and W.C. Sherman, in a Burgess tractor, Signal Corp No. 9, flying from San Antonio to Texas City, TX made the Army's first aerial sketch map:

> *Made in sections, it covered the entire route. Each section showed the country passed over in 10 minutes of flying time. All bearings were taken from a compass mounted near the observer, who used a cavalry sketch case. The map was a detailed one, showing railroads, bridges, wagon roads, towns, streams, woods, hills, prairies, and other topographical features.*[15]

Sketch mapping was then used for aerial observation behind enemy lines during WWI from B.E.2C observation biplanes. This transcript excerpt is from *First Air War*, a 2014 NOVA special:

> *Narrator: This lightweight biplane [BE.2C] has two sets of wings, to generate lift and provide structural rigidity. The pilot sits in the rear, an observer up front. … It is unarmed and its maximum speed is only 72 miles per hour. In a strong headwind it is almost static, literally floating.*
>
> *Gene De Marco: These early BE.2Cs were strictly used for observation in the beginning of the war. They weren't armed in any way and they weren't armored in any way. And they were slow fragile airplanes that could … barely get aloft with two people on board.*
>
> *Narrator: De Havilland designed the airplane for spying on the enemy below.*
>
> *Peter Hart: In the early days, it was really just the pilot, the observer and their trusty notebook and their pen. And they'd go up, and they'd have a map on, strapped to one knee, and they'd have a notebook in the other.*
>
> *Narrator: With no radios to report their observations back to base, this is a primitive operation.*
>
> *Peter Hart: They'd draw a diagram [on the map] on their knee, with notes of what they could see, and then fly over the nearest Army headquarters and just drop … a message bag. And that's all it was. That's all there could be in the first couple of months of the war.*
>
> *Narrator: Basic as the sketches are, they mark a crucial step forward in military intelligence. For the first time, the army has its eye in the sky, and its advantages soon become obvious. With the ability to see the location of the trenches and targets from the air, pilots [and observers] are able to give information to the gunners on the ground.*[16]

Many years later, insect and disease sketch mapping, as described in Klein et al. 1983:

> *Since forest pests and the damage they cause are dynamic and highly variable, the resulting data will also be highly variable. No two sketchmappers will or can be expected to record the same outbreak in exactly the same way. For this reason sketchmapping should be regarded more as an art than as an exact science. It is important at the outset that this be understood, not only by conscientious sketchmappers who find that their data may not be in close agreement*

[14]Denée, T.J. 1997. John La Mountain and the Alexandria balloon ascensions. Historic Alexandria Quarterly. 2(3):5.

[15]Signal Corps file No. 28309; General Scriven, report on progress made in aeronautics in the Army since about 1 March 1913, 7 July 1913. In: Hennessey, Juliette A. 1985. The United States Air Arm. April 1861 to April 1917. Washington, DC: Office of Air Force History, United States Air Force. Chapter IV, pages 76 and 78.

[16]NOVA. 2014. First air war. Bedlam Productions Ltd. For WGBH Boston. http://www.pbs.org/wgbh/nova/military/first-air-war.html (accessed March 2016)

with their peers, or with a subsequent statistically reliable aerial photo survey, but also by the forest manager who may want to put the information to use. Sketchmapping is highly subjective, and the resulting data can be no more accurate than the competence of the sketchmapper or the conditions under which the data was obtained.[17]

… and in Ciesla 2000:

The strength of aerial sketchmapping is that it is a cost-effective means of covering large areas of remote, inaccessible forests rapidly. An experienced aerial survey team can cover up to 750,000 acres in a day. In the Pacific Northwest (Oregon and Washington) in 1995, two teams of two aerial observers each, one representing USDA Forest Service and the other representing the respective state forestry agency, covered the region's 54 million acres of forests in about six weeks at a cost of $70,000, or about $0.0013 per acre (McConnell 1995b).

The weakness of aerial sketchmapping is that data obtained from aerial sketchmapping are subjective and not repeatable. Aerial observers must know their exact location at all times, and even a moment's confusion can result in

Figure 14. *Aerial observer tracking location and recording damage on a paper map during the bark beetle/blow down surveys in 1952. Pilot John Wear. Photo by T.C. Adams. USFS Portland Station Collection, PS-991.*

[17]Klein, W.H.; Tunnock, S.; Ward, J.G.D.; Knopf, J.A.E. 1983. Aerial sketchmapping. In: Forest insect and disease survey methods manual. Davis, CA: USDA Forest Service, Forest Pest Management, Methods Application Group. 15 p.

> *the plotting of an area of damage in the wrong location. The quality of aerial sketchmap data, therefore, depends on the skill and experience of aerial observers and their familiarity with local forest conditions. Weather conditions affecting visibility and air turbulence also influence the quality of aerial sketchmap data.*[18]

Qualifications for aerial sketch mappers, from McConnell 1999:

> *Qualified sketch mapping aerial observers must be able to:*
>
> - *Read maps proficiently. . . .*
> - *Have good eye sight and normal color perception.*
> - *Identify forest disturbance agent signature, which usually come in the form of foliage color change or tree crown or canopy texture change.*
> - *Draw or sketch the affected area on a map . . .*
> - *After the affected area has been delineated on the map, it must be attributed with the causal agent, host, and a relative intensity or tree count of damage.*
>
> *Other valuable qualities of a good sketch mapper include:*
>
> - *A working knowledge of forest insects and diseases, and their hosts indigenous to the survey area.*
> - *A sincere interest in flying a sketch map mission.*
> - *Ability to control motion sickness.*
> - *Ability and experience to plan an aerial survey mission.*
> - *Ground field experience in the survey area.*
> - *Knowledge of meteorology and weather, especially in the survey area.*
> - *Team player.*
> - *50-200 hours of training time in an aircraft.*[19]

Qualifications for sketch map pilots, from Pettinger 1979:

> *The pilot selected for forest insect surveys must have wide experience in flying mountain flying at all altitudes, excellent map reading ability, and skill in flying prescribed flight lines over rough terrain. Sound judgement, even temperament, and a cooperative attitude are also essential to the competent operation of aircraft on this type of mission.*[20]

Research into a variety of techniques have been explored over the years to aid aerial observers.[21] This summary is from 1973:

> *Research to improve aerial survey methods began about 1950. Techniques for sketch mapping were developed and improved by such innovations as strip count sampling, map rolling devices, oblique strip viewers, use of tinted lenses, and the operations recorder.*[22]

Additional aerial survey techniques including satellite sensors, airborne sensors, photography, and sketch mapping were reviewed in 2002-2003 by Forest Health Protection specialists, remote sensing specialists, and the Remote Sensing and Applications Center (RSAC). Conclusions from their report include:

[18]Ciesla, W.M. 2000. Remote Sensing in Forest Health Protection. FHTET Report No. 00-03. Forest Health Technology Enterprise Team, Fort Collins, CO. p. 66.

[19]McConnell, T.M. 1999. Aerial sketch mapping surveys the past, present and future. In: North American science symposium: toward a unified framework for inventorying and monitoring forest ecosystem resources. Proceedings RMRS-P-12. p. 59-60.

[20]Pettinger, L.F. 1979. Detection survey methods aerial and ground. USDA Forest Service, Forest Insect and Disease Management, Portland, Oregon. p. 25.

[21]These and other aerial techniques will be explored in more detail in *The Data* report.

[22]Downing, G.L. (moderator). 1973. Value of visual aerial detection surveys, In: 1973 WFIWC proceedings. p. 85.

> *Once an examination of the current and potential remote sensing methods was done, it quickly became apparent that costs become prohibitive when the need for large scales and higher resolution increase. Although such descriptions such as "intriguing", "promising", "optimistic potential" have been used with today's remote sensing technologies, forest health information needs requiring higher resolutions over large areas of land makes the application of these technologies cost prohibitive....*
>
> *It has been long known that a land manager should never plan a timber sale from solely information off of an aerial survey map. The goal of sketchmapping is to detect and document visible mortality, defoliation and other visible forest change events only. The accuracy concerns are scale related, in that the aerial overview survey is for detection, not project level information needs. If greater information is desired, forest health specialists or land managers can determine what level of accuracy is needed to meet project demands. A combination of sketchmapping, imagery and ground data utilized in a multi-tiered sampling scheme can be utilized in large areas with forest health concerns....*
>
> *Aerial sketchmap overview surveys are currently the staple to forest health information nationally and should continue with an emphasis on training, quality assurance and safety.... Aerial sketchmap overview surveys detect and monitor visible forest health issues; they document the event and get the forest health specialist to the affected area. It was never meant to be an analysis tool. Currently there is no other cost-effective detection process available.*[23]

So, incredibly, the same basic aerial sketch mapping techniques used during the Civil War and World War I are still in use today. As USFS Forest Health Protection (FHP) staff across the nation are annually faced with surveying millions of acres to meet requirements to report on the health of the nation's forests, the reasons for sketch mapping remain valid today: cost effective, timely, and limited resources.

[23]McConnell, T.; Avila, R. 2004. Aerial detection overview surveys futuring committee report. FHTET-04-07. Fort Collins, CO: USDA Forest Service, Forest Health Technology Enterprise Team. 46 p.

Chapter 2
Post World War I – surplus airplanes and pilots

The details of this section, while outside the stated scope, document some important events in the greater history of aerial insect detection surveys.

At the end of World War I (WWI), when surplus equipment and personnel became available for domestic use, natural resource applications for trained pilots and military airplanes were explored. Aerial experimentation proved the airplane a useful tool in natural resource management – especially with fire and insect detection and control.

This article in American Forests shows some of the differences between Canada and the US in their adaptation of aerial programs in the 1920s:

> *In 1927 more than 3,000,000 acres north of Fort Frances, in Ontario, were sketch-mapped from the air by trained foresters. The method employed was the checking of waterways, sketching of forest type boundaries with species and density, and then applying the sketch to aerial photographs. Poison dusting by airplane of forest insect is undoubtedly carried on in Canada on a greater scale than in any other country in the world. The flying foresters have turned their "puffer" machines on the hemlock looper, caterpillars, and the budworm with remarkable success.*
>
> …
>
> *While Canada is fashioning great aerial plans and watching them work in the administration of the forests of the North, American foresters are stoutly maintaining that the airplane can never be more than a distant adjunct to their ground forces. As a consequence hardly more than a dozen planes were performing the past season in the interest of forest protection throughout the country.*
>
> *It matters not whether we believe that airplanes offer a quick way to remedy some of our ailing forest problems, or whether we are content to confine our activities to solid ground. In either event, there must be activity – a remedy. Some power, some development must furnish the germ of progress from which a program will evolve to withstand the demand upon the forests through countless years.*
>
> …
>
> *It does matter if American foresters lean toward the static rather than the dynamic, if they do not move forward to the extent of their opportunity. It matters if they do not meet changing conditions; it matters if they cease to serve to the limit of their capacity.*
>
> *The world has entered a new age – the aerial age, where the tanklike Tyrannosaurus has become a Butterfly. It needs an age where minutes have been turned into seconds, hours into minutes; an age where there is no opportunity to stagnate and still exist. Thus it would appear that if the forestry movement is to serve its real purpose, the men behind it cannot afford to plod along with the Tyrannosaurus. They must accept the wings of the Butterfly.*[24]

Whatever the reasons, two more decades, the Great Depression, and another world war would pass before dedicated resources and federal financial support would become available for systematic annual aerial insect detection surveys in the Pacific Northwest…

[24]Kauffman, E. 1930. Flying foresters, aerial age opens a new era in forest protection. American Forests and Forest Life. 36(4):230.

2.1 The first aerial forest insect detection survey – Canada, 1920

James. M. Swaine conducted the first aerial forest insect damage survey in Canada in 1920, but the first aerial *entomological* surveys were conducted by Eric Heale in 1918 to locate mosquito breeding habitat (Heale 1921).

In 1919, after Heale's mosquito flights, Dr. C. Gordon Hewitt, Dominion Entomologist, then proposed expanding the use of airplanes to forest insect detection surveys:

> *The great development of the aeroplane and its manifold uses during the war have led to much discussion concerning the ways in which it may be used for peaceful purposes.... in Quebec experiments are being made with a view to testing the value of aeroplanes (hydroplanes) in forest protection work, and undoubtedly they will be used in the future for surveying purposes.*
>
> *We have discovered a use for the aeroplane in entomological work, namely, to assist in carrying out surveys of mosquito breeding areas....*
>
> *In forest insect work also, if the utility of the aeroplane or hydroplane for forest protection work is demonstrated, it will be possible to use such a machine for making surveys of timber that is being killed or has already been destroyed by forest insects, for upon such surveys successful control work depends.*[25]

Around the same time, Ellwood Wilson, chief forester for the Laurentide Paper Company in Quebec was exploring the use airplanes for fire protection and timber type mapping. In 1918, after the signing of the armistice at the end of WWI, twelve Curtiss HS 2 L Flying Boats were turned over to the Department of Naval Affairs in Canada by the US Navy. Wilson applied for the use of two of these seaplanes on behalf of the St. Maurice Forest Protective Association to conduct experiments using planes for fire patrol and aerial mapping.[26] Lt. Stuart Graham, who flew a Curtiss HS-1L during the war in Britain, was hired as the pilot and Walter Kahre as flight engineer (Shaw 2001). Wilson recalled the loan thus:

> *With the introduction of airplanes hope of using them sprang up, and in 1915 an aviator was practically engaged, but no machine could be obtained for the amount of money available. In December 1918, the idea came up again and the Hon. Jules Allard, at that time Minister of Lands and Forests of Quebec, promised his support in making an experiment... It was learned that the United States Navy had turned over to the Department of Naval Affairs of the Dominion Government ... twelve seaplanes which had been used in a joint patrol ... The Minister kindly consented to loan two machines, and on the 5th of June [1918], one was flown to the base near Grand Mere. The pilot, Lt. Stuart Graham, R.N.A.S. [Royal Naval Air Service], immediately returned to Halifax and flew the second machine up, arriving the 23rd of June.*[27]

Pilot Stuart Graham's assessment of these 'flying scouts in forestry':

> *The work has of necessity been carried out along experimental lines, owing to the required initiation of lumbermen into flying work and also the introduction of flyers into the realms of the forester.*[28]

Forester Wilson accompanied Graham as an observer on these pioneering flights and published an enthusiastic account, extolling the many benefits a forester experienced viewing forests from the air:

> *The observer sits in a cockpit in the front and has an ideal opportunity to see the country, take photographs and to make sketches and notes. All this can be done easily and comfortably on a small drawing board held on the knees. Altimeter and compass are within easy view....*

[25]Hewitt, C. G. 1919. The use of the aeroplane in entomological work. In: The Agricultural Gazette of Canada. Ottawa: Government Printing Bureau. p. 877.

[26]Wilson, E. July 1919. Seaplanes to be used for forest fire patrol work in Quebec. American Forestry. 25(307):1238.

[27]Wilson, E. 1920. The use of seaplanes in forest mapping. Journal of Forestry. 18(1):1

[28]Graham, S. 1920. Flying scouts in forestry have come to stay. Canadian Forestry Journal. January 1920. p. 14.

It may interest the profession to give a brief description of how our forests look from the air and what can be seen by a flier.… With the exception of the lumbered areas, all these [forest] types can be easily distinguished from the air and lines of demarcation can be seen and sketched in with an accuracy and ease absolutely unattainable on the ground. It is, as every forester knows, often extremely difficult to say where one type leaves off and another begins, but this is not the case from the air. For rapid reconnaissance work, the best map available of a country can be taken into the air and the types sketched on, using lakes or other prominent features as units of measurements for areas …

From my experience I should say that a forester could get a better idea of fifty square miles of unknown territory in two hours' flying than he could after two weeks spent on the ground. Let me warn my readers that they must not be too skeptical about the results which can be obtained, as I have seen many preconceived ideas completely changed after short flights over forest areas. Until one has flown he can have absolutely no idea of how much can be seen from the air, especially after a few flights. It is exactly like having a colored relief map spread out below one for study.
…
The writer feels that aerial work is destined to play a large and important role in the work of the forester, particularly in inaccessible and unmapped country and in making the progress reports which are so necessary. It will eliminate an immense amount of drudgery and allow of rapid and relatively accurate reconnaissance work which has been entirely out of the question in the past, as for instance, the reconnaissance of whole states, provinces or regions which would in the ordinary course take years to accomplish and whose cost would be prohibitive.[29]

Figure 15. *Timber types recorded on a contour base map during Wilson's pioneering 1919 experimental flights in Quebec. Source: American Forestry. June 1920. p. 328.*

[29]Wilson, E. 1920. The use of seaplanes in forest mapping. Journal of Forestry. 18(1). p. 2-5.

Wilson, who wrote a monthly *Canadian Department* column for American Forests, also published *The Use of Aircraft in Forestry* in the June 1920 edition. Again he referenced sketch mapping:

> *It was wonderful flying over a wooded country, to see how easily the boundaries of the various timber types could be traced and by taking a map into the air, the various types, the approximate size and density of the timber could be sketched on it [Figure 15], and that, too, much more accurately than from a ground reconnaissance.*[30]

In a later column, Wilson reported on the July 1920 Society of Northeastern Foresters annual meeting. This account included entomologist Dr. J.M. Swaine's first experience flying over forests:

> *Mr. Roland D. Craig and Doctor Swaine of the Commission of Conservation and the Dominion Entomological Branch, were at the meeting of the Northeastern Foresters and afterwards took a trip in the Laurentide Company's seaplane, piloted by Lieutenant Stuart Graham, in order to see for themselves what kind of work could be done in reconnaissance on a large scale such as the Commission of Conservation is doing in a forestry survey of Ontario. They were much pleased with the results of their flight and very enthusiastic about the possibility of the machine.*[31]

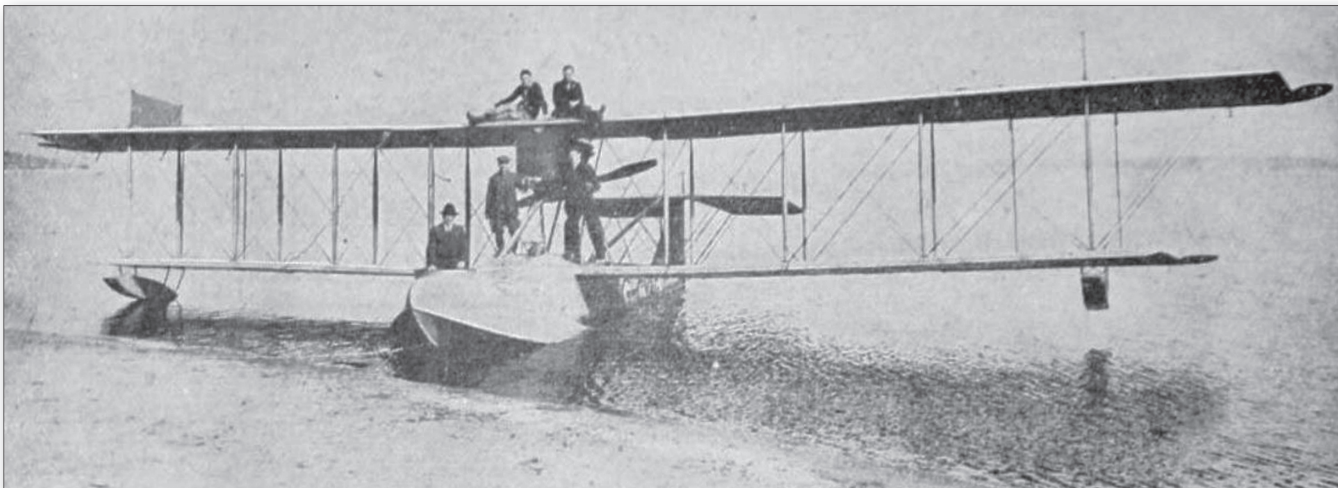


Figure 16. *Aerial forest reconnaissance at Haileybury, Ontario. Seated on top, Captain McEwen, pilot; H. McClatchey, mechanic; standing, G.H. Edgecombe, Roland D. Craig, and Dr. J.M. Swaine. Source: Roland D. Craig, An aerial survey of the forests in northern Ontario. Canadian Forestry Magazine. November 1920. p. 516.*

Swaine's need to determine the extent and direction of spread of a large spruce budworm outbreak in the forests of Northern Ontario was impossible to determine with ground surveys before the end of field season. So, a few months after Swaine's initial flight, the first known airplane surveys for forest insect detection were made between September 15 and October 7, 1920. The entomologists who conducted the surveys were Dr. James M. Swaine (Chief of the Division of Forest Insects, Dominion Entomological Branch) and M.B. Dunn (Division of Forest Insects, Dominion Entomological Branch).[32] This account by Roland D. Craig appeared in the November 1920 edition of the Canadian Forestry Magazine (Figures 16-19):

> *A most interesting experiment in the use of aircraft for forest investigations was recently conducted in Northern Ontario. The Air Board furnished a sea-plane and crew for the joint use of the Commission of Conservation and the Entomological Branch of the Department of Agriculture for the purpose of mapping in the forest areas and also to study the progress of the spruce budworm infestation which is spreading throughout the northern pulpwood forests….*

[30]Wilson, E. 1920. The use of aircraft in forestry. American Forestry. 26(318):326-328.

[31]Wilson, E. 1920. Canadian department. American Forestry. September 1920. 26(321):568.

[32]Swaine, J.M. 1921. A survey of our forests from the air. The Agricultural Gazette of Canada. Dominion Department of Agriculture, Ottawa. January-February 1921. 8(1):21-23.

> *On September 15, Col. Robt. Leckie … piloted the machine from Ottawa to Haileybury with Mr. Clyde Leavitt, Chief Forestry of the Commission of Conservation and Dr. J.M. Swaine, Forest Entomologist, as passengers. … Col. Leckie had to return to Ottawa for his trans-Canada flight and left Capt. P. Wickens … as pilot. Later, Capt. McEwen … relieved Capt. Wickens. Dr. Swaine and Mr. M.B. Dunn conducted the entomological investigations while G.H. Edgcombe and the writer mapped in forest types. Haileybury was used as a base until Oct. 7th when the party move to North Bay and the survey continued in that region.*[33]

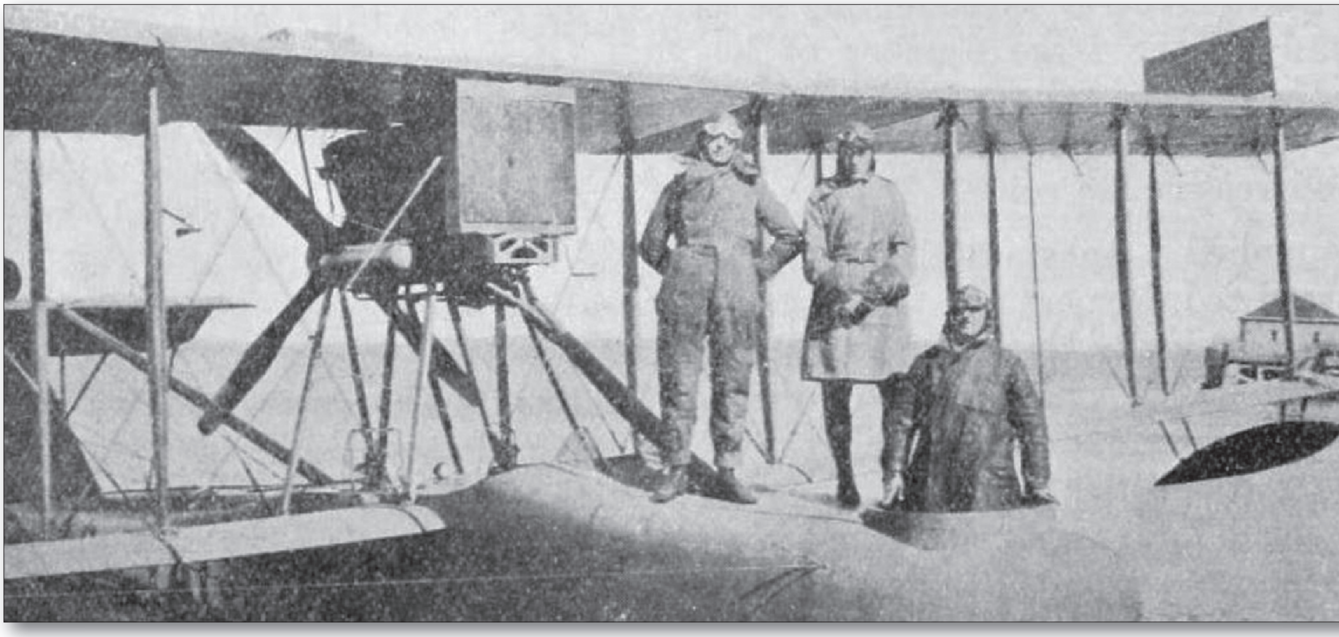


Figure 17. *Left to right: C. McEwen, R.D. Craig, and J.M. Swaine on Lake Temiskaming, Northern Ontario. 1920. Source: J.M. Swaine. 1921. A survey of our forests from the air; Agricultural Gazette of Canada. January-February 1921. 8(1):20.*

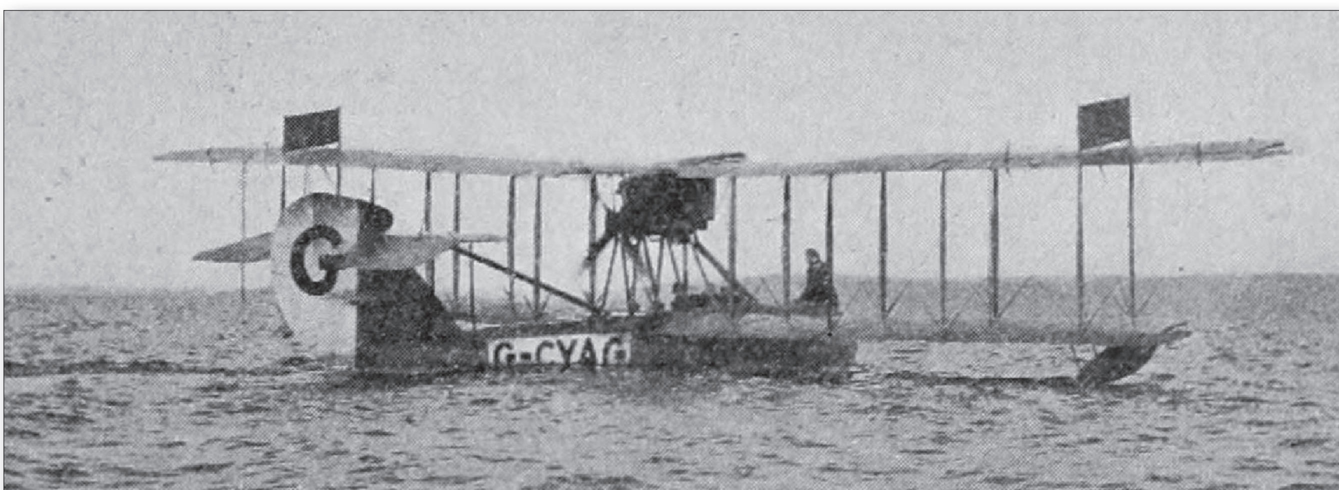


Figure 18. *Survey plane, Curtiss Flying Boat on Lake Temiskaming, Northern Ontario. 1920. Source: J.M. Swaine. 1921. A survey of our forests from the air. Agricultural Gazette of Canada. January-February 1921, 8(1):21.*

Somewhat anticlimactically, after all the groundwork he'd laid, the forest insect survey was barely noted in Ellwood Wilson's November 1920 column:

> *It is interesting to note the increasing use of aircraft in forestry work. Besides the two Canadian companies operating their own fleets, one of two seaplanes and the other of three, the Air Board in co-operation with the Department of Lands*

[33]Craig, R.D. 1920. An aerial survey of the forests in northern Ontario. Canadian Forestry Magazine. November 1920. p. 516.

and Forests of Quebec, has established a station on Lake St. John and will patrol for forest fires and take photographs of unexplored country. . . . A flight to determine roughly the areas in western Quebec and eastern Ontario infested with the spruce budworm was made by the Air Board carrying representatives of the of the Entomological Branch of the Commission of Conservation.[34]

Insect Studies by Airplane

A most interesting experiment in the use of aircraft for forest investigations in northern Ontatio, Canada, is described by Roland D. Craig, F. E., Commissioner of Conservation, in the November issue of "Canadian Forestry."

"The Air Board furnished a sea-plane and crew for the joint use of the Commission of Conservation and the Entomological Branch of the Department of Agriculture for the purpose of mapping in the forest areas and also to study the progress of the spruce budworm infestation which is spreading throughout the northern pulpwood forests.

"The machine used was a Curtiss flying boat, officially known as the H. C. 2-L type. It has a wing-spread of 78 feet and is equipped with a 360 h.p. liberty naval type motor. In addition to the pilot, the boat will carry two observers.

"This is believed to be the first instance in which aircraft has been used in insect studies and the results have proved most satisfactory. In a few hours flying over the region between Kipewa Lake and Larder Lake, the limits of the budworm infestation and the extent of the damage was determined by noting the discoloration of the affected balsam and spruce trees. This pest has already destroyed millions of dollars worth of balsam and spruce in Quebec and New Brunswick, but it has just made its appearance in Ontario. It is of the utmost importance to the timber owners and the Government to find out quickly the areas affected and the direction in which the infestation is spreading in order that the pulpwood may be utilized before it is rendered uesless, which usually occurs within two years after the trees are defoliated. In addition to the aerial observations, a thorough investigation of the infestation is being conducted on the ground in the areas shown to be attacked."

Figure 19. *News of the Canadian aerial survey appeared on page 5 of the January 10 & 17, 1921, USFS Service Bulletin.*

Aerial surveys for spruce budworm were again conducted during the summer of 1921. Frank C. Craighead, an entomologist on leave from the USDA Bureau of Entomology (BoE), worked with Swaine on the Canadian spruce budworm project. While it does not appear that Craighead participated in the 1920-1921 aerial surveys, he was on the project when those first surveys took place (Swaine and Craighead 1924). In 1924 Swaine and Craighead published this summary of the 1920-1921 aerial budworm surveys:

AIROPLANE SURVEY OF THE TIMISKAMING REGION

It was necessary to determine as rapidly as possible the extent of the Timiskaming [spruce budworm] infestation and the direction in which it appeared to be spreading. A ground survey party was sent out in July, 1920, to obtain this information but it was quite impossible to cover the whole area in that manner before winter.

Later in the season an opportunity was offered to examine the infested territory from the air. Through the cooperation of the Dominion Air Board, the Commission of Conservation and the Entomological Branch, an aerial forest reconnaissance was conducted over the budworm infested country north and west of Lake Timiskaming. The Air Board furnished a Curtiss flying boat, type H.S.2.L., with a wing spread of 78 feet, and equipped with a 360 horse-power Liberty engine. The possibilities of an air survey appealed to us strongly and the results were even beyond our

[34]Wilson, E. 1920. Canadian Department. American Forestry. 26(323):694.

expectations. From a height of 3,500 feet it was possible to determine the different types of timber to locate the blocks of spruce and balsam accurately. The budworm infested trees are reddish or yellowish in colour and from the air they were easily distinguished and the area of infestation could be determined readily.

…

When possible to arrange it, two observers should be carried, one mapping the country on each side of the machine. Even then it will sometimes be advisable to make two trips over particularly interesting sections.

A ground survey over the territory covered in the two weeks flying would have occupied a survey party for at least two seasons and would have given only a very small part of the information that was obtained from the air. In the view from the air, with the whole country spread out below, the distribution of the timber types, the more immune black spruce areas, the hardwood areas, the areas of dead balsam and the relations of the infestation to the different timber types, as well as the distribution of the outbreak, may be determined more accurately than by any type of ground survey that could be imagined. The air survey must be carried out in conjunction with an intensive survey of conditions from the ground in selected areas so that each type of study supplements the other. The air survey in addition to determining the area of the infestation discloses the best localities for sample plots and other study areas, and the use of the air machines makes it possible to utilize for study purposes areas that would be inaccessible by ground travel. On the other hand after

Figure 19a. *The first office occupied by forest entomologists in the old insectary. U.S. Department of Agriculture. Washington, DC. December 1902. Seated left to right: H.E. Burke, Assistant Forest Expert; J.L. Webb, Assistant Forest Expert; and A.D. Hopkins, in charge of Forest Insect Investigations. Standing in the background is F.C. Pratt, Assistant in Truck Crop Investigations. Photo and caption: Burke 1946, p. 3a.*

a study and a careful location of the various types of infestation from the ground and examination of these from the air gives data for interpreting the conditions on the whole area. For obtaining data of this general type the advantage of the air survey are unique.[35]

In the fall of 1923 Dr. A.D. Hopkins, Bureau Chief, Forest Insect Investigations, Washington, DC (Figure 19a) retired[36] and Dr. F.C. Craighead (Figure 19b) returned to the US to take over behind him.[37] With Craighead's first-hand exposure to Swaine's aerial detection surveys, it's interesting to note that even with Craighead in a position of authority, systematic annual aerial surveys would not commence under his leadership for another 24 years.

Figure 19b. *Frank C. Craighead (left), George Hofer, and P.D. Sergent. Recruise of a [bark beetle] control area. July 1911. On the summit of Elkhorn Mountain, Oregon. Photo and caption: Burke 1946, p. 10b. F.C. Craighead's 1977 comment on the photo:* "George Hofer is in the middle, with the gun. He came over from Switzerland. A very good woodsman and naturalist. They all carried guns, then, in insect work. I don't know why." *From: Maunder 1977, p. 5.*

2.2 A link to forest entomology in Oregon and Washington, 1920

According to an article in the *USFS Service Bulletin* by A.J. Jaenicke (Figure 21), J.M. Swaine met with western US forest entomologists the month after he'd completed the surveys in Canada. Apparently, by 1920 these informal meetings of western entomologists had been held annually for four years[38], but this was the first time that Canadians had attended. Swaine's recently-explored aerial survey techniques were undoubtedly a topic of discussion; technology transferred.

[35]Swaine, J.M.; Craighead, F.C. 1924. Studies on the spruce budworm [Cacoecia fumiferana Clem.]; Part I - a general account of the outbreaks, injury and associated insects. p. 11-13.

[36]Burke, H.E. 1946. My recollections of the first years in forest entomology. Berkeley, CA. June 28, 1946. p. 25. Hardcopy, R6 aerial survey program files. Sandy, OR.

[37]Maunder, E.R. 1977. Western Forest Entomology History: An interview with Dr. Frank C. Craighead, Sr. March 1977. p. 9.

[38]These informal meetings were eventually chartered in 1949 as the Western Forest Insect Work Conference (WFIWC).

Figure 20. *Early ground surveys included seeking vantage points from ridge tops. Jenny Creek, OR. June of 1920. Photo by J.E. Patterson. USFS Portland Station Collection, PS-2251. A few months after this photo was taken, the photographer, J.E. Patterson, an entomologist with the Bureau of Entomology, attended a meeting with J.M. Swaine (see Figure 21), where he and other western US entomologists undoubtedly learned about the aerial forest insect detection surveys just completed by Swaine in Canada.*

Forest Insect Conference

A meeting of the Government workers on forest insect problems in the Rocky Mountain region and Pacific Coast regions was held at Coeur d'Alene October 25-30. At this meeting Canadian officials from Ottawa and British Columbia took part as well as representatives of the Bureau of Entomology and the Forest Service. Since the Oregon Agricultural College is much interested in the protection of Oregon's timber resources against insect depredation, it sent a representative to the meeting. The attendance included:

Dr. J. M. Swaine, in charge of forest insect studies in Canada.

Ralph Hopping, in charge of forest insect control operation on Government lands in British Columbia.

James Evenden, in charge of the Federal forest insect station at Coeur d'Alene.

J. E. Patterson, in charge of the Federal forest insect station at Ashland, Oregon.

Professor W. J. Chamberlin, of the Oregon Agricultural Experiment Station, who for the past few years has devoted all of his time to the study of methods of controlling insect losses in Oregon forests.

A. J. Jaenicke, insect control specialist, U. S. Forest Service.

A meeting of this kind is held annually in order to familiarize the specialists with each other's work and the problems which still demand attention. This was the fourth annual meeting, but is the first one in which the Canadian Government has taken part. The Dominion Government is spending thousands of dollars each year on the control of bark beetles which threaten the yellow pine stands of British Columbia; and since the same insects are causing losses in the yellow pine forests of Washington, Oregon, and California, the opportunity afforded at this meeting for the American specialists to meet the Canadian workers in the same field was of much value. In like manner the Canadians were much interested in the results of the efforts of the Forest Service and the private owners to keep insect depredations under control.

Methods of controlling the destructive bark beetles have been worked out, but there is still considerable room for improvement in the methods themselves and the application of them. --A.J.J.

Figure 21. *In October 1920, Alex J. Jaenicke, insect control specialist for the Pacific Northwest Region of the U.S. Forest Service and other western entomologists, including J.E. Patterson, met with J.M. Swaine. Source: November 15 & 22, 1920, USFS Service Bulletin, p. 17.*

2.3 Airplanes for fire detection in Oregon and Washington

The use of airplanes for natural resource work was also being explored in Washington, Oregon, and California, but the main focus was fire patrol in conjunction with the US Forest Service. Under a cooperative agreement between the Forest Service and the Army Air Service, aerial forest patrols in the Western US from 1919-1921 (Figures 22-25) were conducted for civil defense and fire detection. When the agreement expired in 1921 it was not renewed by the Forest Service, who cited high costs and low fire detection rates (Aerial Age 1923).

A more colorful explanation for the discontinued use of these aerial forest patrols is from Kauffman 1930:

> *In San Francisco, late one October evening in 1920, an ardent and somewhat visionary young officer wrote* finis *to his report to the Chief of the United States Army Air Corps with the startling prophecy that "the day will come when large numbers of men and equipment will be carried by airship to the scene of a forest fire, both men and equipment dropped by parachute, while the airship will rain down fire-extinguishing chemicals from above."*
>
> *These conclusions, no doubt, resulted from an overdose of youth and faith in the ingenuity of America's aeronautical engineers and chemists. But they were not wholly without foundation. This young officer had in three dry months directed the thirty-seven airplanes which made up the aerial forest fire patrol in California and Oregon over 16,332,900 square miles of dense forests. He had witnessed his fire-fighting planes roar out daily and fly 3,996 hours over a distance of 476,085 miles without the loss of a single life. Too, his pilots and observers had discovered 1,632 forest fires, 818 of which they reported in advance of ground detection agencies.*
>
> *Considering this, there was little wonder that the enthusiastic young flying officer closed his report of the 1920 aerial forest fire patrol which was detailed by the War Department to assist the Forest Service in the fire control work on the National Forests, with a prophecy that appeared at first glance to offer permanent relief for the fire-weary foresters.*
>
> *But, unfortunately, only the eyes of the young officer and his fellow airmen saw this fireless vision; the foresters could not, or did not, get the first glimmer of it. As a result, Colonel W.E. Gilmore, in command of the patrol the following year, advised in his report that there appeared to be an attitude of criticism against, if not actual opposition to, this activity on the part of many field officers of the Forest Service, due in part to objections which, as a rule, follow in the wake of innovations along any line of accomplishment – the tendency to cling with jealous tenacity to the old established order of things.*
>
> *Without a doubt, this negative, or apathetic attitude toward the fire-fighting plane resulted from lack of familiarity on the part of the foresters to its value and work. The huge question mark that was plainly visible in their minds, in most cases, vanished when contact was made with the airmen and their roaring, plunging sky ships. But the fact remains that the following year, 1922, the War Department withdrew its active support and since that time the airplane has been a very distant adjunct of ground forces.*[39]

While opposed to the use of airplanes for fire patrol, Coyle 1929 was in favor of fire control and sketching fire perimeters from a plane:

> *The use of an airplane for fire patrol has these disadvantages: To come within a reasonable expenditure, an airplane would have to patrol 5,000 square miles. In patrolling territory of this size, the patrol would necessarily be intermittent and the danger of depending on an intermittent means of fire detection is obvious, where the spread of fire is at all rapid. Under certain weather conditions, large fires may be discovered from an airplane at a distance of 40 or 50 miles, but at that distance it would be impossible to pick up the small fires, or fires at the start, which it is the mission of the observation system to detect. It would seem that, except in the very worst fire weather, and then only as supplementary to the other observation systems, the airplane would hardly pay for itself in this particular work.*

[39]Kauffman, E. 1930. Flying foresters, aerial age opens a new era in forest protection. American Forests and Forest Life. 36(4):198.

As a means of control and supervision, the airplane marks an epoch in the progress of the control of large fires. A fire that has advanced three or four miles, and it will usually be necessary to extinguish every foot of this line of fire 40 miles long. To do this promptly and to make the best use of the forces at his command, the man in charge of the fire must have an accurate knowledge of the location and extent of the line of fire. Making a reconnaissance to get this information, either on foot, mounted, or with the aid of an automobile, will take him a great many hours, during which time the line of fire is constantly changing and advancing, and as a result he never has a clear idea of his problem.

On the other hand, it is an easy matter with a little training for an observer from an airplane to plot on a map an accurate outline of the fire. The actual plotting can be accomplished from the air in 10 or 15 minutes, and with proper liaison establish, a tracing or overlay of the fire can be furnished to the chief in charge of the ground forces at the fire every 30 minutes, if necessary. The plotting of the fire, if maps are available to the observer, is a comparatively simple process. He has only to establish the relationship between the ground distance, as seen at his flying altitude, with that of his map distance, to draw fairly accurately the line of the fire. It is very much like sketching the features of one scale on a map of another scale which you place alongside of it. The observer, because he has a comprehensive view of the fire, can make a clear estimate of the situation and give much valuable advice to the ground forces.[40]

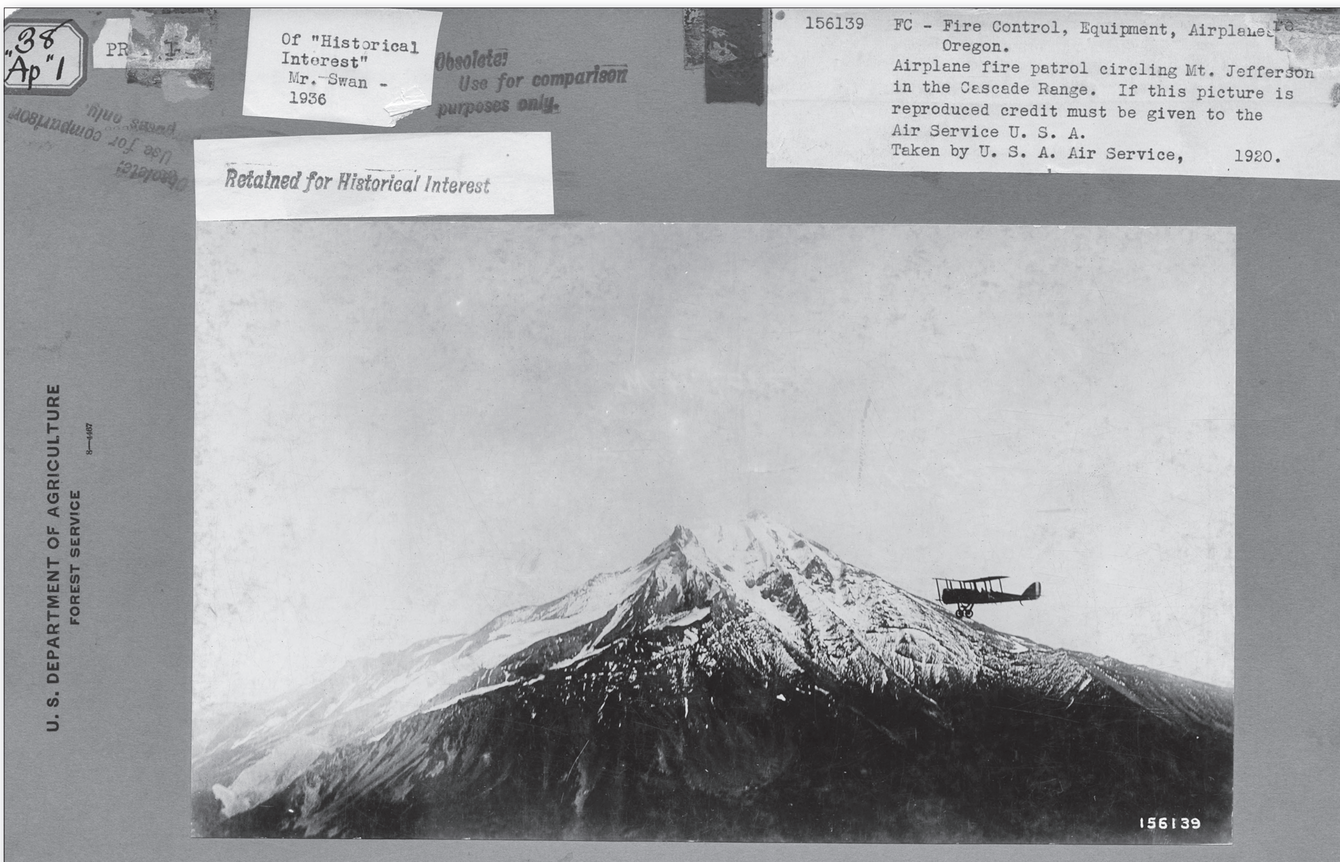


Figure 22. *Airplane fire patrol circling Mt. Jefferson in the Cascade Range. 1920. Photo by U.S.A. Air Service. USFS Historic Photo Collection, #156139.*

[40]Coyle, L. 1929. Use of airplanes in forestry. Journal of Forestry. 27(7):833-834.

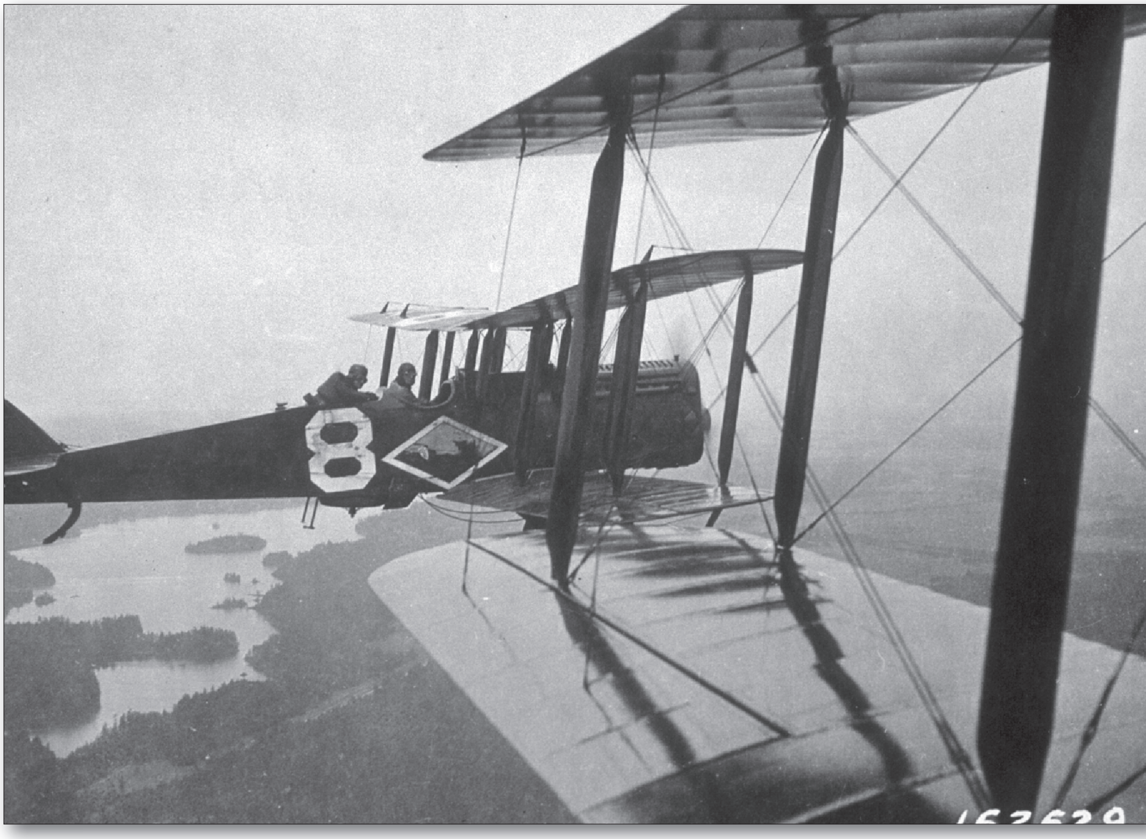


Figure 23. *Forest fire air patrol in Washington state, 1921. USFS Historic Photo Collection, #162629.*

Figure 24. *Forest Patrol Airplane, Olympic Air Patrol. 1921. Olympic National Forest, WA. Photo by W.J. Paeth. USFS Historic Photo Collection, #162658.*

Figure 25. *Aerial fire detection bi-plane. c1921. USFS Historic Photo Collection, #162695.*

From a 1925 issue of *The Forest Worker*:

The Airplane Does its Bit in Fire Control

Nine Army airplanes [Figure 26] gave important assistance this summer in the protection of national forests against fire. They were borrowed by the Forest Service for a period of 10 weeks. One officer was detailed by the Air Service. Pilots and mechanics of the Air Service Reserve were employed by the Forest Service, and forest officers acted as observers.

. . .

The two planes using Spokane as a base made 83 flights during the season, reported 12 fires ahead of the ground lookouts, scouted 66 fires, and dropped 150 message of which only 2 failed to reach their mark. Because of the scarcity of emergency landing fields in the Kootenai, Pend Oreille, and Kaniksu Forests, these planes in most instances returned to Spokane without landing. This mean unbroken flights from 300 to 400 miles. They flew over the roughest of mountain country and in all kinds of weather and atmospheric conditions – sometimes, for example, encountering columns of heated air over the fires which would raise them vertically for hundreds of feet, having the opposite effect to the ordinary "air pocket" or "hole". Yet in 400 hours of flying not a single injury occurred to men or equipment.

Forest officers report that they find flying an extraordinary help in getting acquainted with their terrain. The supervisor of the Chelan Forest expressed the wish that every man in his force could take a flight for the sake of such a new conception of the country for which he was responsible. In scouting fires the best results were obtained by local forest officers who had previous air patrol experience. One of the districts in which planes were used has already suggested that hereafter picked forest officers should be given special training as aerial observers.[41]

[41]USFS. 1925. The forest worker. Washington, DC: USDA Forest Service. October 1925. p. 19.

Figure 26. *Fire patrol at Eugene. Cascade National Forest, OR. 1925. USFS Historic Photo Collection, #204809.*

Again from Kauffman 1930:

> *It is not difficult to picture the dramatic activity in the forest when the droning fire-fighting ships of the future go into action. One can easily sense the uncertainty of a still, dry sunrise in August when treacherous electric storms ride the upper air currents. One can almost thrill as the mind-picture is drawn of the swift patrol planes taking off from the airports on patrol duty over the danger zones, while the great transports are rolled out primed for action. One can see the nervous but well organized, activity when the word comes by radio phone from the winged scouts that the red enemy has struck. We see the huge transports, loaded with men and equipment, roll into the wind and point towards the emergency landing field nearest the fire. We see the hawk-like patrol planes riding the smoke clouds as they curl skyward, or slipping low into a canyon to measure the action of the blaze.*[42]

[42]Kauffman, E. 1930. Flying foresters, aerial age opens a new era in forest protection. American Forests and Forest Life. 36(4):200.

2.4 Airplanes for forest insect control work, 1921

In 1921, USDA's use of airplanes for insect control also came into play. In Cleveland, Ohio a city entomologist imagined aerially distributing arsenate of lead powder via a hopper attached to the fuselage of a bi-plane (Figure 27). He conveyed his idea to the Ohio Experiment Station and worked with the Army Air Service to design the hopper. In June of 1921, Mr. H.A. Gossard, a state entomologist with the Ohio Agricultural Experiment Station tested the new airplane and hopper to distribute arsenate of lead on a six acre stand of catalpa trees in Troy, Ohio, to control an infestation of catalpa sphinx caterpillar. "*Within three days after the application, 99 per cent of the caterpillars were dead and were strewn on the ground, hanging from the trunks and limbs, making the grove indescribably foul and repulsive*." (Aerial Age 1923)

Figure 27. *Airplane with hopper attached to fuselage for aerial dusting with arsenate of lead for gypsy moth. USDA Forest Service, Historic Photo Collection, #UGA1275044. Photo courtesy Bugwood.org.*

Chapter 3
Entomological events in the western US leading up to the survey – 1916-1946

In the years leading up to the Oregon and Washington systematic surveys, western Bureau of Entomology (BoE) entomologists opportunistically experimented with a variety of aerial detection techniques. With limited resources, personnel, and access to airplanes, these trials were often hurried and results less than satisfactory. Even so, the potential for aerial work was clear to this small group of enthusiasts, so aerial photography, reconnaissance, and sketch mapping were sporadically explored. These early experiments also allowed the entomologists to obtain a working knowledge of the personnel, equipment, support organizations, and techniques needed to successfully run an aerial detection survey program for the day when funding and resources would finally become available.

For a variety of reasons, prior to 1916, relationships between the BoE and the USDA Forest Service were strained (see Burke and Wickman1990) and the entomologists' role in early survey and control projects was often confusing. Officially they were 'Technical advisors' for any state, private, or federal agency involved in insect survey and control, but these roles often became blurred during project implementation on the ground. But from 1916-1946 stronger working relationships were established between the individuals and agencies who, by 1947, were united in their efforts to detect and control insect depredations.

1916:

In 1916, forester Alex J. Jaenicke was hired by the USDA Forest Service, District 6[43] in Portland, OR and placed in charge of insect control for the Region.[44] In the following years, he established a cooperative working relationship with BoE entomologists, including F.P. Keen.

From a 1974 Keen (FPK) interview conducted by Elwood R. Maunder (ERM):

> *ERM: What was the Bureau's relationship to the Forest Service … ?*
>
> *FPK: Theoretically the Bureau of Entomology had the expertise of forest insect control and the ability to make surveys and recommendations. It also was in the best position, professionally, to see that recommended action was carried out. … The entomological research was all done in the Bureau.*

[43]In 1916, the USDA Forest Service District 6 was comprised of Oregon, Washington and Alaska; AK was re-assigned to a new District 8 in 1921; District 6 was designated Region 6 (North Pacific Region) in 1930; then designated as Region 6 (Pacific Northwest Region) in 1966. Region 6 acquired northeast WA from Region 1 in 1974. Source: National Archives and Records Administration; Records of the Forest Service Record Group 95.9.6.

[44]In the USDA Forest Service, July Field Program, 1916, the US Forest Service District 6 (later Region 6), A.J. Jaenicke was listed as "Insect Control" on page 17. In later years he was listed as a "forest examiner on insect control". In 1916, the 'District' office was located in the Beck Building in Portland, OR.

ERM: In other words, you are saying it was up to the Bureau of Entomology to provide a plan of action and up to the Forest Service to put the plan into action.

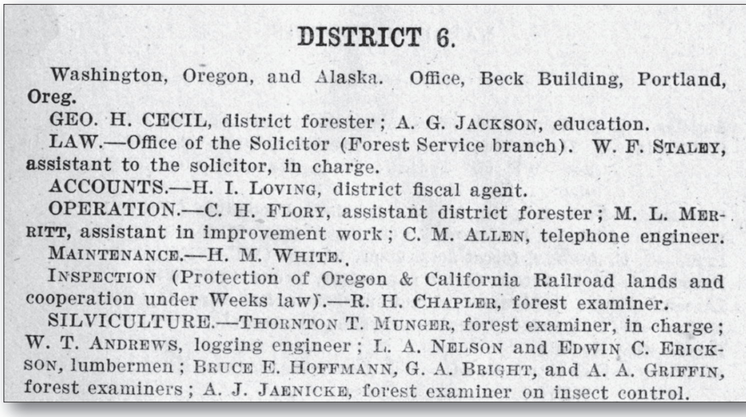
FPK: The Forest Service left research … to the Bureau. The Forest Service had some men both in Region 6 and Region 5 who took charge of the [ground] survey and control work. For instance, Hopping was here at 5 and A. J. Jaenicke at 6. They were control agents. They supervised control efforts under timber management; they were also involved in making [ground] surveys. But they did not contribute greatly to research. That was the first development of inter-bureau cooperation.[45]

This relationship between the BoE entomologists and Jaenicke (USFS) continued throughout Jaenicke's career, until his retirement in 1955. Because Jaenicke was the major player on the USFS side of the R6 survey and control efforts … and because his successor, Benton Howard took over supervision of the aerial survey program in 1961, Jaenicke's R6 career is used to highlight the beginning of the USFS portion of the aerial survey program's administrative history (see Figure A-1 in Appendix 2).

1917:

Figure 28. *Conference of Bureau of Entomology and Forest Service Men at Ashland, Oregon. June 1917.*
Front row: F.P. Keen, Thomas E. Snyder, Ralph Hopping. Back row: Albert W. Wagner, John M. Miller, Alex. J. Jaenicke.
Hopping represented Forest Service Region 5 (California) and Jaenicke Region 6 (Oregon & Washington), Snyder was on a special trip from the Washington office of the Bureau of Entomology. Albert Wagner was an Entomological Ranger recently transferred from the Missoula station of the Bureau that had just closed when Josef Brunner left for West Virginia. Photo and caption source: H.E. Burke.1946, My recollections of the first years in forest entomology. Berkeley, CA. June 28, 1946. p. 25c.
Additional information, courtesy of Malcolm M. Furniss and the WFIWC archives: Miller and Keen were stationed at the time at Ashland studying cone & seed insects; they were subsequently stationed at laboratories at Palo Alto, Berkeley and Portland.

[45]Maunder, E.R. 1974. Oral history interview with F.P. Keen. Session 1. November 15, 1974. Lafayette, CA. p. 8.



DISTRICT 6.

Washington, Oregon, and Alaska. Office, Beck Building, Portland, Oreg.

GEO. H. CECIL, district forester; A. G. JACKSON, education.

LAW.—Office of the Solicitor (Forest Service branch). W. F. STALEY, assistant to the solicitor, in charge.

ACCOUNTS.—H. I. LOVING, district fiscal agent.

OPERATION.—C. H. FLORY, assistant district forester; M. L. MERRITT, assistant in improvement work; C. M. ALLEN, telephone engineer.

MAINTENANCE.—H. M. WHITE.

INSPECTION (Protection of Oregon & California Railroad lands and cooperation under Weeks law).—R. H. CHAPLER, forest examiner.

SILVICULTURE.—THORNTON T. MUNGER, forest examiner, in charge; W. T. ANDREWS, logging engineer; L. A. NELSON and EDWIN C. ERICKSON, lumbermen; BRUCE E. HOFFMANN, G. A. BRIGHT, and A. A. GRIFFIN, forest examiners; A. J. JAENICKE, forest examiner on insect control.

Figure 29. *A.J. Jaenicke, forest examiner on insect control. Source: USFS, January Field Program, 1918. p. 76.*

1918:

From the 1918 *Annual Reports of Department of Agriculture, Bureau of Entomology*:

Investigations of Insects Affecting Forest Resources

By far the most extensive insect-control reconnaissance that has been carried out to date is the "California [ground] survey", which was completed during the year. This was organized as a cooperative project in which a number of California companies, the Forest Service, and the Bureau of Entomology were engaged. The general supervision of the survey was assigned to the assistant forest entomologist, Mr. J.M. Miller, who has charge of the Pacific slope field station.[46]

1919:

From the USFS *Service Bulletin*:

District 6 – North Pacific District news item:

Insect control problems, particularly on the National Forests of the Rocky Mountain and Pacific Coast regions, were the subject of a recent conference at Ashland, Oregon, between the Bureau of Entomology personnel of the Western Forest Insect Field Stations and the Forest Service insect control men of Districts 2, 5, and 6, Messrs. Pearce, Hopping, and Jaenicke respectively. This is the third annual meeting of this kind, and the data which have already become available as a result of these cooperative investigations on the Pacific Coast have real value in the successful application of control measures, especially in the yellow pine infestation in the West.

By the careful collection of data jointly by the Bureau and the Forest Service on control projects, it is possible within a few years to satisfactorily test the efficacy of control measures now in use and even to make progress in their improvement. If the money is available, a large cooperative control project will be carried out in California this year in a yellow pine-sugar pine stand. The data and conclusions as a result of this work will have wide application.

J.M. Miller, of the Bureau's Ashland station, is directing the study under what is known as the "Ashland Conference Plan", which has the formal approval of both the Forest Service and the Bureau.[47]

1920:

See Chapter 2.

[46]USDA. 1918. Annual reports of Department of Agriculture, Bureau of Entomology. p. 12.

[47]Anon. February 2, 1920. USFS Service Bulletin. p. 11.

1921:

Pine Beetle Menace in Southern Oregon

The enormous damage which the western pine beetle can inflict on the yellow pine stands of this region is clearly shown by a serious situation which now prevails in southern Oregon and in which private lands, portions of the Crater, Fremont, Modoc, and Klamath National Forests, the Klamath Indian Reservation, O&C grant lands and public domain are involved: On an area of about 1.2 million acres almost equally divided into private and federal lands, now containing a stand of 12 billion feet of yellow pine, and western pine beetle has killed at least 1.5 billion feet of pine of good quality and high value in the last ten years. In other words, in the decade 1911-1920 the beetle has killed more than 10 percent of the stand. To prevent the recurrence of these heavy losses on federal lands, Congress will probably appropriate $150,000. This item is included in the Deficiency Bill and has already passed the House. The private owners of southern Oregon and northern California have been insistent in their demand for this legislation since without it they are unable to proceed with the protection of their own timber against the beetle menace due to the intermingled character of the private and federal ownerships.

If money is made available by Congress, control operations will begin on the federal and private lands within the project in the spring of 1922. The Bureau of Entomology's advice will be followed by all the private and government agencies concerned. It is the purpose to inaugurate on this so-called Southern Oregon-Northern California [SONC] project, a permanent plan of control. After the wiping out of the epidemic on the area, a certain amount of so-called maintenance work will be done annually to keep the beetles from again increasing to large numbers.

*The control operations carried on in the Whitman and Ochoco a number of years ago were directed against the mountain pine beetle. (*D. monticolae*), an insect which is primarily a menace to lodgepole pine, sugar pine, and finally to yellow pine when it occurs in a mixture with lodgepole. The control operations on this project will be largely restricted to combating the western pine beetle (*D. brevicomis*) a beetle which kills only yellow pine.*

A.J. Jaenicke.[48]

1922:

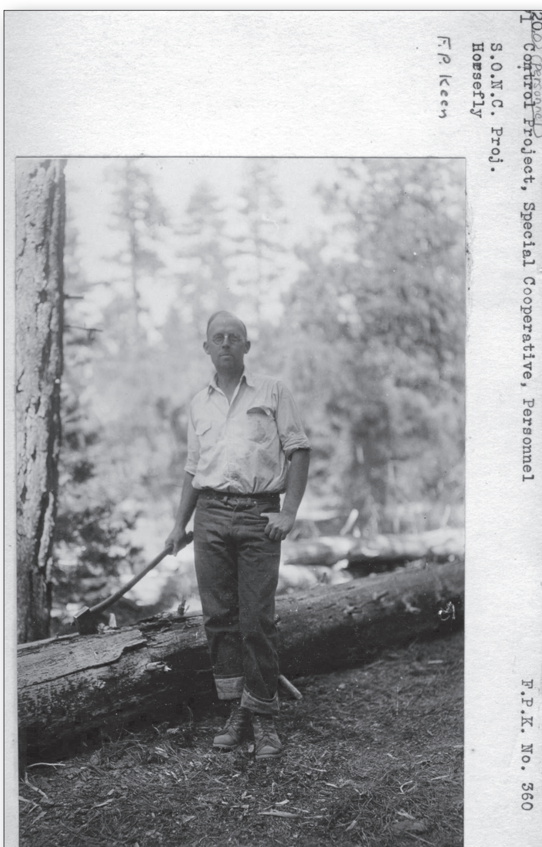


Figure 30. *F.P. Keen on the Southern Oregon-Northern California (SONC) project. USFS Portland Station Collection, FPK-360.*

[48]Jaenicke, A.J. December 1921. USFS Six-Twenty-Six.

From a 1974 interview with F.P. Keen (FPK) (Figures 30 and 30a), conducted by Elwood R. Maunder (ERM):

FPK: Then in 1921 with the start of the southern Oregon-northern California [SONC] project, I was sent up to Klamath Falls, Oregon to take charge of the Bureau's part of that.

ERM: What was your relationship with the local people?

FPK: I was made a member of the board of control for the Southern Oregon-Northern California Pine Beetle Control Project and elected chairman at its first regular meeting on April 8, 1922. I had to form my own opinion and make my own way. The fellow that had made a preliminary survey of the work was A.J. Jaenicke [Figure 30a]. He was the Forest Service designated control agent. He had made a preliminary survey of the whole project area and had outlined the project subdividing it into three nearly equal areas of interest, the private owners, the Indian Service, and the Forest Service. When I entered the scene I was first involved in helping with the survey by taking one area that was the Forest Service area, and going over it very thoroughly. When .the project was ready to go, a board of control was set up with representation of all parties involved. The board was responsible for hiring men, getting supplies, and determining policies.[49]

Figure 30a. *F.P. Keen, W.G. Durbin, A.J. Jaenicke, Harvey Abbey. Southern Oregon-Northern California (SONC) Project, May 1922. Photo by F.P. Keen. USFS Portland Station Collection, BUR-3211.*

Walter J. Buckhorn ("Buck") is considered the founder of Oregon and Washington aerial surveys. Buck's first temporary job with the federal government was with the USDA Forest Service working for the southern Oregon-northern California (SONC) control work in 1922. From Furniss 2000:

Buck's arrival in Lakeview in 1921 coincided with a vast outbreak of the western pine beetle, Dendroctonus brevicomis LeConte *(*Coleoptera: Scolytidae*), involving 1.25 million acres of ponderosa pine (*Pinus ponderosa Lawson*) forests east of the Cascade Mountains. Plans were under way by the USDA Forest Service and other agencies to control this bark beetle by felling infested trees … then peeling and burning the bark that contained beetle broods. In May 1922, Buck left*

[49]Maunder, E.R. 1974. Oral history interview with F.P. Keen. Session 1. November 15, 1974. Lafayette, CA. p. 9.

> *his $600.00 per year job as a sawyer with W.P. Fuller Lumber Company and hired on with the Forest Service control work. Initially, he felled trees, but within a year he was put in charge of a 50-man crew.*[50]

1923:

Figure 31. *Walter Julius Buckhorn. Photo by F.P. Keen. Photo courtesy Western Forest Insect Work Conference archives.*

Buck's employment with the Forest Service didn't last long. F.P. Keen quickly hired him as his assistant with the Bureau of Entomology (BoE) on the SONC project in 1923.

From Furniss 2000:

> *Technical supervision of this project, known as the Southern Oregon-Northern California Project (SONC), was the responsibility of forest entomologists of the USDA, Bureau of Entomology, including F. Paul Keen, stationed at Ashland, Oregon. Keen was so impressed with Buck that he hired him in June 1923 as Field Assistant, on a temporary appointment. Buck was stationed at Klamath Falls, Oregon, and his job involved "reconnaissance surveys of beetle infested timber." These [ground] surveys were physically and technically demanding, and they provided reliable information on the location and numbers of infested trees on which control operations were based.*[51]

Buck's initial employment with the BoE in 1923 marks the other starting point of the R6 aerial survey program's federal administrative history (see Figure A1 in Appendix 2).

Ironically, Buck's single year of initial employment with the Forest Service came full circle some 40 years later at the other end of his career. In 1961 Buck and his survey and control group were separated from the entomologists in USFS Research and re-assigned to the R6 insect control group in the Division of Timber Management working for Jaenicke's successor - Benton Howard. When Jaenicke's and Buckhorn's programs merged in 1961, this group formed a new staff that would eventually become present-day R6 Forest Health Protection staff (see Figure A1, p. 227).

Buck's description of this work:

[50]Furniss, M.M. 2000. Walter Julius Buckhorn (1899-1968)—legendary forest entomologist, not of the classroom kind. American Entomologist. 46(3):133-134.

[51]Ibid. p.134.

Figure 32. *Walter J. Buckhorn (with compass) and F. Paul Keen. USFS Portland Station Collection, FPK-343.*

Under general supervision as chief of a 3 man party I conducted seasonal surveys of forest insect conditions in ponderosa pine stands. Infestation intensity was measured by cruising designated 640 acre plots, and distribution was determined by running strips up to 12 miles in length through each area.[52] *I trained two temporary assistants in the art of running compass [Figure 32], pacing, and mapping, also to detect, measure, mark and record beetle infested trees. I compiled the survey data and prepared maps of the infestations.*[53]

[52]From a 1971 story in Timberlines (p. 19-20); Forty-one years in the bush, by Corwin E. (Slim) Hein: "…*Beetle control projects throughout the drought years of the 30s provided winter employment for many smokechasers. Among R6 pioneers in beetle control work were some of the finest men with whom I have had the good fortune to work: Alex Jaenicke and F. Paul Keen, and Messrs. Buckhorn and Whiteside who were the legmen for the first two. And what legmen they were! Buckhorn was not over 5'6", but woe to him who would challenge Buck to a 12-mile cross-country hike*. …"

[53]From Walter J. Buckhorn's 1929 application for employment with the Bureau of Entomology working for F.P. Keen in the newly-established Portland Lab. Courtesy M.M. Furniss and the Western Forest Insect Work Conference archives.

In 1923, A.D. Hopkins, Chief of the Bureau of Entomology retired and F.C. Craighead assumed leadership of the Bureau in DC (see Chapter 2).

> **Forest Insect Investigations**
> F.C. Craighead, Entomologist in Charge
>
> *Doctor Craighead has just returned from a three weeks' trip in the Western States, during which he attended a conference of the western men at Klamath Falls, Oreg. On the way out a day's stop was made at St. Paul, Minn., to discuss, with Doctor Riley and Doctor Graham, plans for cooperative work with the University of Minnesota. One day was spent at the Northern Rocky Mountain Station, Coeur d'Alene, Idaho, with Mr. Evenden; a day each at the Forest Service District offices at Portland, Oreg., and San Francisco, Calif., and at the Forest Insect Station at Palo Alto, Calif.*
>
> *The remainder of the time was devoted to meetings at Klamath Falls. Those present were Doctor Burke, Messrs. Miller, Edmonston, Keen, Evenden, Patterson, Hauge, and Person. Plans were laid for concentrating all work for the next few years on barkbeetle [sic] problems, to meet the increasing demands for our service on this very important problem. Coordination of all efforts on both control and investigative work will be a feature of the new plan under the regional leadership of Mr. Miller and Doctor Burke. More direct contact between the District Forest offices and Forest Insect field stations will also be arranged.*
>
> *The conference was entertained on two occasions – once by the Klamath Falls Rotary Club and again by the Chamber of Commerce, where expressions of appreciation were voiced for the services the Bureau is rendering timberland owners in the protection of their forests from barkbeetles. Messrs. Craighead, Miller, and Evenden spoke of various phases of the Bureau work.*
>
> *The excellent support the Bureau is receiving from the Forest Service and timberland owners is very encouraging.*[54]

1924:

After the SONC project ended and the Ashland Laboratory was closed in 1924, Buck (still on a temporary appointment) accompanied Keen and the other BoE entomologists to their new assignment at Stanford University in Palo Alto, CA. From Furniss 2000:

> *Buck was well liked at Stanford and his work was valued highly by others on the staff besides Keen. However, adventure was beckoning and, possibly hastened by a degree of discomfort in such an academic setting, he resigned in December 1926 to attend Sweeney Automotive and Aviation School (AAS) at Kansas City, Missouri.*[55]

1925:

After working with Keen, Buckhorn, and other entomologists, Jaenicke wrote an opinion piece expressing his support of USFS/BoE collaboration:

> *There is a real need for a better appreciation of the role of insect protection in Western forest practice on the part of foresters. It seems to me that this need can best be met by more attention to forest entomology in the Forest Schools and to joint consideration of forest insect problems by foresters and entomologists in planning and carrying on forest research. Much has already been accomplished in placing effective forest insect control on a firm basis, but as time goes on, there is a clearer realization that the difficulties and uncertainties still ahead can be removed only by the cooperative effort of foresters and entomologists.*[56]

---

[54] Craighead, F.C. December 1923. Monthly letter of the Bureau of Entomology. USDA. Number 116.

[55] Furniss, M.M. 2000. Walter Julius Buckhorn (1899-1968)—legendary forest entomologist, not of the classroom kind. American Entomologist. 46(3):134-135.

[56] Jaenicke, A.J. 1925. The place of entomology in silviculture - comments on Mr. Peirson's paper. Journal of Forestry. 23(4):376-377.

Meanwhile, further experiments with airplanes were made by western entomologists. From Eaton 1942:

Use of Airplanes in the West

The earliest attempt to survey forest insect damage from the air [in the western US] was made by Miller … in 1925. A photographic and an observation plane were supplied by the Army Air Service, and the flights were made over the Sierra National Forest.[57]

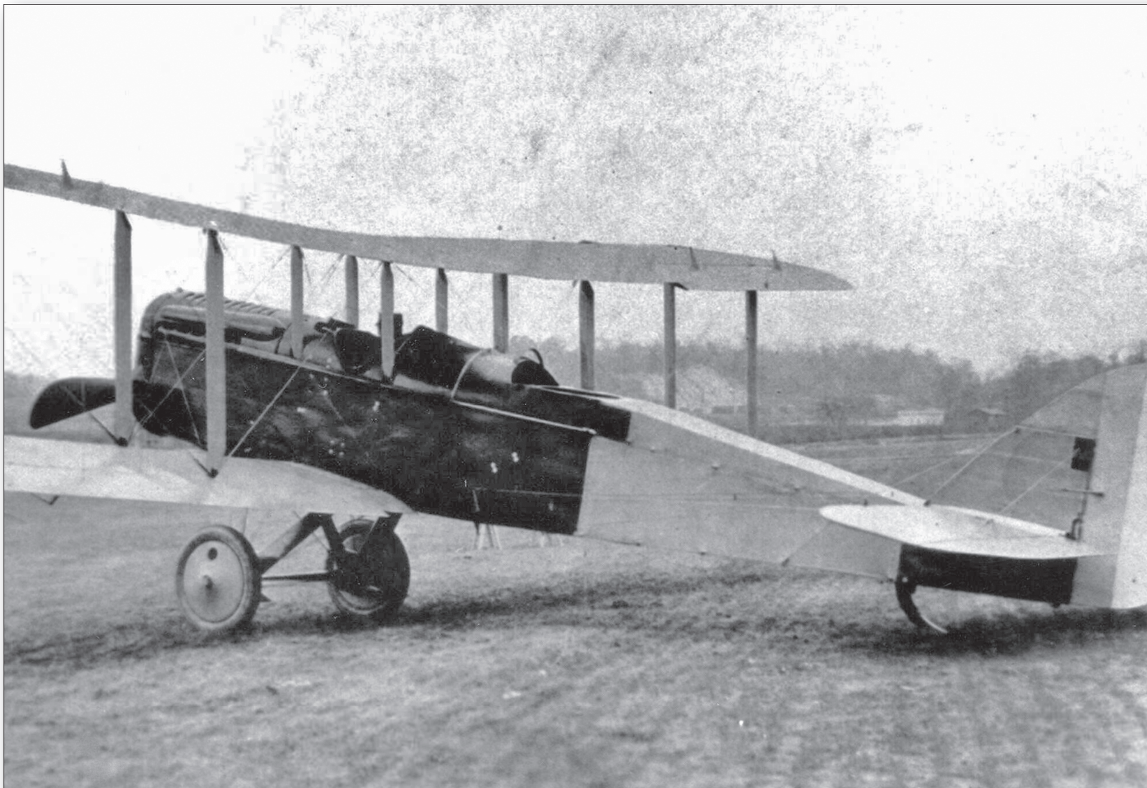


Figure 33. *DeHaviland D4H. 1918. Courtesy: Oregon State University, Gerald Williams Special Collection.*

J.M. Miller provided this account of his flight in the *Western Division News Letter*, June 1925:

Spotting bug trees at 13,000 feet

During the period May 3 and 6, Lieutenant W.R. Taylor of the 15th Photo Section of the Air Service made a trip to North Fork and went over the ground to be covered in the air survey of the San Joaquin areas. Tests were made of the hyper-sensitized panchromatic films and the filters used by the Air Service in photographic mapping. These tests demonstrated that, under the right light conditions, the sorrel and red trees could be registered in contrast to the normal green trees of the forest.

Plans were made to carry out the survey early in May. Three different dates were set for the flight but each time storms and unfavorable weather conditions made postponement necessary. For a time it seemed as though the project would dissolve in rain and Pacific Coast fog. A final attempt was set for May 26th and this time the weather gods were favorable. At 10:00 A.M. two DeHaviland [Figure 33] Army planes left Chrissey Field at San Francisco, heading straight as the crow flies for the San Joaquin areas. In one hour and twenty five minutes they were over the infested area at Bass Lake. This incidentally, is some time record as the best that has been done by any other means of transportation amounts to about nine hours.

[57]Eaton, C.B. 1942. The adaptation of aerial methods to the forest loss survey. Berkeley, CA: USDA Bureau of Entomology and Plant Quarantine. 20p.

One of these planes, piloted by Lieutenant Taylor carried the mapping camera and the operator from Chrissey Field. The other traveled as an observation plane and was piloted by Sergeant Fowler. The rear cockpit of this plane was occupied by the party whose initials appear at the bottom of this news note and an effort was made to spot on a map the infestation as it could be seen, the object being to test out the observation as well as the photographic method.

The areas were at an elevation of 3,500 to 4,500 feet and the photographs were taken from an elevation of about 12,500 feet. The observation plane kept about 500 feet above this to allow for the maneuvering of the other ship for photographs. About one hour was spent over the areas and altogether nearly twenty square miles were photographed. The return trip to Crissey Field required over two hours due to a strong head wind. A landing was made at Modesto for lunch and the planes landed at the base field at 4:30 P.M. A report on the results of the expedition will have to wait until the Air Service Laboratory finishes the pictures. These will be out in a few days. In viewing the areas from the air the red and sorrel trees stood out in strong contrast and an excellent idea of the general distribution of the infestation was formed. I do not maintain that I got anything like 25 per cent of the bug trees on the map or that many of those I did get were near their correct location. I do not doubt but that someone familiar with this sort of work from the air would have been more effective as an observer. - J.M.M.[58]

1927:

Figure 34. *F.P. Keen took aerial photos of western pine beetle-killed trees on the Modoc N.F. from this Forest Service fire patrol open-cockpit biplane in 1927. Photo no. 6515 by J.M. Miller. Photo and caption courtesy of Western Forest Insect Work Conference archives.*

[58]Western Division News Letter, Forest Insect Investigations, Bureau of Entomology, USDA. Palo Alto, California. Mimeo. Published monthly from March 1923 -June 1928. Copy of all issues is in possession of M.M. Furniss, destined for deposit in the Special Collections and Archives Library, University of Idaho, Moscow. Source: WFIWC website: http://wfiwc.org/history/vignettes/miller-keen

Shooting Bugs from the Air
By F.P. Keen

Forest Entomologists, keeping pace with the times, have already found many ways in which the airplane can be used in dealing with forest insect problems. Chief among these is in connection with extensive surveys of large areas of infested timber. Several flights of western forests have been made recently, and the technique of making insect surveys from the air has been fairly satisfactorily worked out. There are three general methods that can be employed:

> *Visual observation of the area as a whole; in which the observer makes a mental picture of the location, distribution and relative intensity of the infestation.*
>
> *Sample strip counts; in which the observer tallies all conspicuous dead trees within his range of vision between certain markers on the plane as it flies over a course of known length.*
>
> *Aerial photographs of sample plots; in which an aerial camera, equipped with a fast lens, "G" color filter and panchromatic plates, is used, and vertical "shots" are taken of sample plots at an elevation of about 5,500 feet. The color filter causes the yellow foliage of the dead trees to stand out white, in striking contrast to the rest of the trees, so that the number of such trees on the sample plot can be easily counted and the average run of infestation determined.*

The three methods can usually be combined during one flight over an area, so that in a few hours' time an estimate can be secured of the insect damage over a large area - work which would normally take several weeks to do on the ground.

In September I had the opportunity of making such a flight over the Happy Camp District of the Modoc National Forest. The District 5 air-patrol plane, piloted by Captain M.S. Boggs, was detailed to the project through the courtesy of the Forest Service, and to the Forest Supervisor, George W. Lyons, was allotted the task of serving as weather prophet and to advise Mather Field when air and light conditions would be satisfactory for the flight.

Monday, the twenty-sixth, dawned bright and clear, and Supervisor Lyons, trusting to his luck as an amateur Father Ricard, telephoned the field for the plane to come on. In the next two hours, while I negotiated forty miles of mountain road from camp to Alturas, the plane covered the two hundred miles from Sacramento to Alturas and landed on the field only a few minutes after me. Following a hasty lunch we donned helmets and goggles, strapped on the "chutes", wound up the DH-4, and in a moment Captain Boggs had it climbing skyward, like a Chalcophora (angulicollis*) scared from a bug tree, and heading toward Happy Camp Mountain.*

On reaching the area we circled Happy Camp lookout tower and headed toward Timber Mountain. When over the plots to be photographed I unbuckled the safety belt, knelt on the seat and hung out over the side of the fuselage in preparation to shoot at the proper moment. Captain Boggs maneuvered the plane over the plot and at a given signal shut off the motor, turned the nose up, tilted the plane to the side (a most disconcerting procedure), and as the plane settled and the vibration of the propeller ceased I clicked the camera and climbed back to the safety to change plates and prepare for the next shot. After taking a dozen exposures, both verticals and obliques, we headed back to Alturas and landed safely at the field, after spending an hour and a half in the air and covering an area that would have taken a week to survey on the ground.

The first day we used a "G" filter with ordinary panchromatic plates, but upon developing them found that the negatives were too weak for the light conditions that prevailed on the area. You see, the Supervisor was almost as good a prophet as a Native Son, and so it started to cloud up by noon and was quite overcast by four o'clock.

And the next day it rained!

On the third day Captain Boggs had to return to Mather Field and so a second flight was attempted, even though storm clouds were drifting overhead and the chances of taking pictures looked none too good. However, we hopped off at eleven o'clock, sailed up through the clouds and bumped over the air holes, and soon were back over the area. By a great stroke of luck the clouds now cleared away, and the sun shone bright and clear and gave us a wonderful opportunity to get some clear pictures. This time we had equipped the camera lens with a "K-2" filter, and a dozen exposures were again made, with better coordination of signals that had prevailed the first day. We spent about two hours over the area, obtaining a wonderful view of the country as a whole, and I discovered two heavily-infested areas that I had not seen from the ground. On returning to Alturas the plates were developed and proved to be excellent pictures of the country, but the filter had not given us as much contrast to the "bug" trees as might be desired.

Each experience of this kind gives us a better understanding of the possibilities of the airplane in forest insect survey work and also the technique of the methods which will give the most satisfactory results. For instance, on this flight we learned that the "G" filter will have to be used to bring out the greatest contrast in the yellow trees, also that except under very favorable light conditions a hypersensitized panchromatic plate will be necessary. Exposures of 1/120 or 1/155 of a second are required on account of the vibration and speed of the plane. Oblique views are best secured at elevations of less than 2,000 feet, for if one looks down at too sharp an angle too much of the ground between the trees comes into view, and the area doesn't look like a forest at all but more like a scattered brush flat. The vertical shots should be taken at an elevation of from 4,000 to 6,000 feet above the forest, so that the pictures will cover at least 40 acres of ground surface and yet not be so far away that the infested trees cannot be distinguished. There are also many little problems connected with the taking of the pictures, such as getting the light to the rear, proper coordination between cameraman and pilot, operation of the camera etc., which can be gained only through experience.

One of the finest things about the air method is the general picture one gets of the situation as a whole. The relative intensity and distribution of infestation on different parts of an area is very striking and impressive. When an area has been seen from the air, you have the satisfaction of feeling that nothing has been missed and that your estimate of the situation is a comprehensive one.

Airplanes as an aid to forest insect reconnaissance have already proved themselves of value. Who knows how soon it will be before every forest insect field station will include in its personnel a pilot and a trained air bug observer, and on its property list a late model "Spirit of Dendroctonus"?[59]

Meanwhile, Buck was pursuing his own flying adventures. Furniss 2000:

Evidently, Buck had more than being a mechanic in mind when he enrolled in Sweeney AAS. On February 19, 1927, John M. Miller, in charge of the Forest Insect Laboratory at Palo Alto, wrote:

> *I enjoyed your letter and was glad to learn that the airship is coming along all right (and) that you expect to be flying it one of these days ... Let us hear from you once in a while as we are all interested in how you are getting along. Dr. (F.C.) Craighead (Chief of Forest Insect Investigations, Washington, DC) said that perhaps we could give you a chance to fly for us when you come back.*[60]

While Buck did not come back to fly for the BoE, he did take another temporary appointment with Miller and Keen as a Field Assistant from April 1927-December 1927.

1928:

Unfortunately, Buck's flying career, begun April 1928, came to an abrupt end on September 2, 1928, when his plane was wrecked and his partner Gordon Willey died in a crash in Dighton, Kansas. Again, from Furniss 2000:

After graduating from Sweeney AAS in April 1928, [Buck] acquired an American Eagle OX5 biplane, which he hangered at Anthony, Kansas. From there he flew around the state, "engaged in carrying passengers on scenic flights, aerobatics at public gatherings, and giving students flying instruction." *According to associates, these "aerobatics" included climbing out onto the wing in mid-air with his partner and co-owner, Gordon Willey, of Belle Plaine at the controls.*[61]

Buck was not involved with the crash, but he gave up flying and headed back out West.

[59]Western Division News Letter, Forest Insect Investigations, Bureau of Entomology, USDA. Palo Alto, California. Mimeo. Published monthly from March 1923 -June 1928. Copy of all issues in possession of M.M. Furniss, destined for deposit in the Special Collections and Archives Library, University of Idaho, Moscow. See more at: http://wfiwc.org/history/vignettes/miller-keen

[60]Furniss, M.M. 2000. Walter Julius Buckhorn (1899-1968)—legendary forest entomologist, not of the classroom kind. American Entomologist. 46(3):135

[61]bid.

1929:

The Western Forestry and Conservation Association (WFCA) supported establishing a Forest Insect Laboratory in Portland, OR in 1929:

> *Research in another area was greatly needed. [E.T.] Allen took up the matter with Senator McNary, the able legislator who had already done such yeoman service for the cause of better forestry, and with the endorsement of the Western Forestry and Conservation Association, an authorization was approved by Congress for $15,000 for the establishment in Portland of a Forest Insect Laboratory of the Bureau of Entomology, with F.P. Keen appointed as the entomologist in charge of research and control.*[62]

The new office was set up in the same building as the Pacific Northwest Forest and Range Experiment Station:

> **Bureau of Entomology establishes a forest insect field station in Portland – F.P. Keen in charge**
>
> *The Bureau of Entomology has established a forest insect field station at Portland to serve the states of Oregon and Washington with advice regarding forest insect pests and to conduct research. This office will be in charge of Mr. F.P. Keen who for many years has been connected with bark-beetle projects in OR and CA; his assistant is Mr. J.A. Beal. They have established their office adjoining the Forest Experiment Station at 501 Lewis Building, Portland.*[63]

As soon as he set up the new Portland laboratory, Keen permanently hired Walter J. Buckhorn as a Scientific Aid with the Bureau of Entomology (Furniss 2000). When Keen hired Buck into that permanent position in 1929, he set Buck on his path towards establishing the aerial survey program in Oregon and Washington.

Buck worked out of Portland for the rest of his career; first for Keen and then for Robert L. Furniss. Furniss (RLF) replaced Keen as head of the Portland Lab in 1942 and remembered Buck in a 1977 interview with R.C. Larson (RCL):

> *RCL: First, you mention Buckhorn being a flier and working at the Station. But I heard he was something of a character, a popular man. Could you describe him a little bit?*
>
> *RLF: Well, that's a pretty hard thing to do. Buck was, I suspect, the most colorful individual the Bureau ever had in the West … Buck was a fabulous character, one of these people that are naturally endowed with observational quality and skills of many kinds. He was not formally schooled. I forgot where he peeled off, but he had very little schooling. But he had a way of expression; he could convey his ideas very, very well. In this skill of observation he was ingenious … he invented a lot of things we used. Mechanically, he kept our equipment in shape. He could fly, fact is, he was a stunt flier, wing-walker and that kind of stuff…. just fabulous. A fellow to really be admired. He had a little philosophy with his crews he took into the woods … "Always leave the camp in a little better shape than when you found it." I think this illustrates his concept of things, his public responsibility.*[64]

And from Cowlin 1988:

> *Walter J. Buckhorn joined Keen's staff as a scientific aide soon after the field office opened in Portland. Previously, he had worked on insect control projects in southern Oregon since the early 1920s. Although not a college-trained entomologist, he had many talents and contributed much to entomological research.*[65]

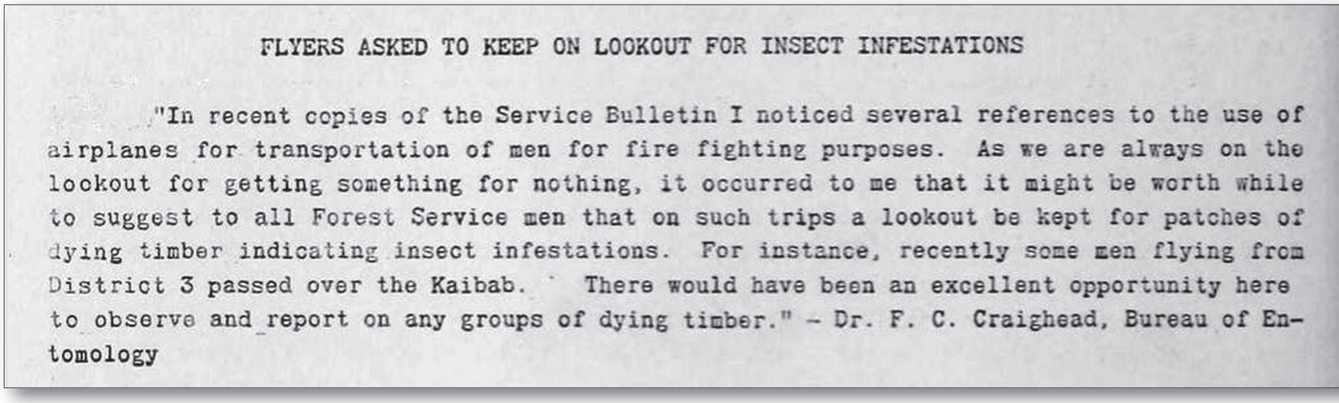
[62]WFCA. 1949. Forty years of western forestry, a history of the movement to conserve forest resources by cooperative effort 1909-1949. Portland, OR: Western Forestry and Conservation Association. p. 48.

[63]From '*Station News Items*', in Forest Research Notes issued by the Pacific Northwest Forest Experiment Station. Oct. 20, 1929. Hardcopy, Cascade Head Experimental Forest. Note: The Lewis Building is located on the NE Corner of SW 4th and Oak in downtown Portland, OR.

[64]Larson, R.C. 1977. Western forest entomology history: an oral history interview with Robert L. Furniss. October 14, 1977. Portland, OR. Durham, NC: Forest History Society. p. 11.

[65]Cowlin, R.W. 1988. Federal forest research in the Pacific Northwest. The Pacific Northwest Research Station. October 1988. p. 54.

In 1929, F.C. Craighead, placed this request in the *USFS Service Bulletin* asking for help detecting dying timber from the air, because aerially surveying the vast forests of the West was still too much for the Bureau's small staff and limited resources:



FLYERS ASKED TO KEEP ON LOOKOUT FOR INSECT INFESTATIONS

"In recent copies of the Service Bulletin I noticed several references to the use of airplanes for transportation of men for fire fighting purposes. As we are always on the lookout for getting something for nothing, it occurred to me that it might be worth while to suggest to all Forest Service men that on such trips a lookout be kept for patches of dying timber indicating insect infestations. For instance, recently some men flying from District 3 passed over the Kaibab. There would have been an excellent opportunity here to observe and report on any groups of dying timber." - Dr. F. C. Craighead, Bureau of Entomology

Figure 35. *From the USFS Service Bulletin, December 2, 1929, Volume 13, Number 48, page 8.*

1930:

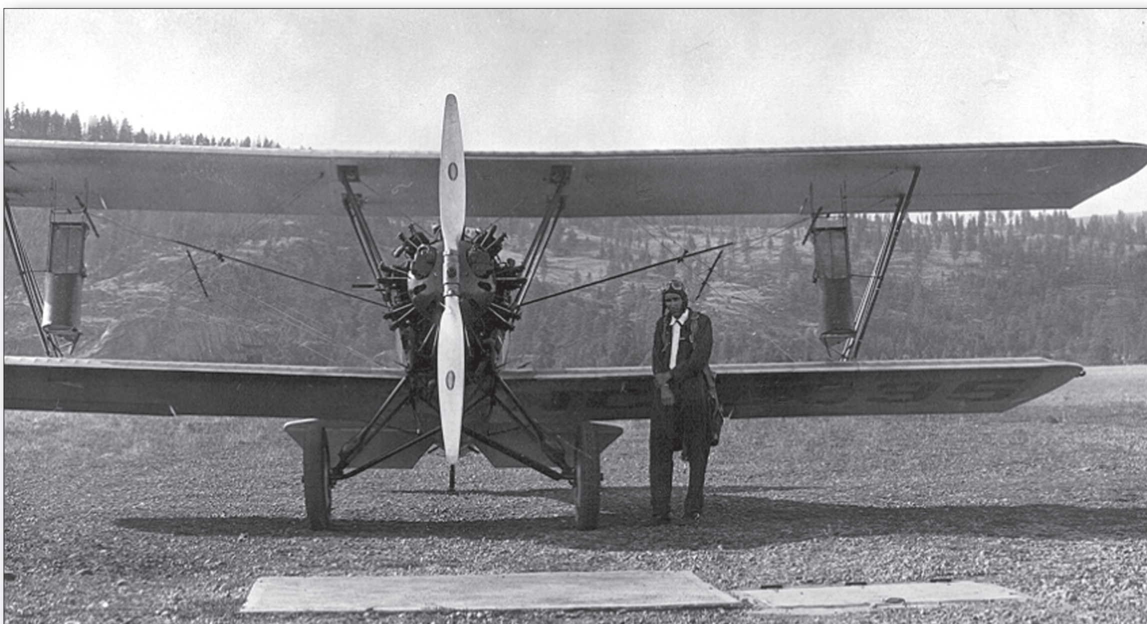


Figure 36. *Tom Terrell and the biplane in which he made the first forest insect aerial survey in the northern Rocky Mountains, 1930. Photo and caption courtesy Western Forest Insect Work Conference archives.*

In 1930 Tom T. Terrell of the Coeur d'Alene, Idaho Forest Insect Lab (Figure 36) made the first aerial survey of forest insect damage in the northern Rocky Mountains:

> *The first flight of the survey could not be called auspicious; it was to be over Yellowstone National Park from a field at Livingston, Montana. I had maps of the Park but nothing for the 65 miles between Livingston and the Park. The pilot had a railroad folder that showed a line going straight south to the Park. Away we went and got lost in the Absaroka Mountains where we were caught in a violent rainstorm. The plane was a small open-cockpit biplane, the pilot in the rear and me up front. The engine went quiet! Then loud pounding behind me! I was about to dive over the side and pull the*

ripcord when I discovered that the pilot was pounding on the plane to get my attention. He got it. He wanted to know if I didn't think we ought to go back? He had cut the engine so he could talk to me. I most certainly agreed with him. I was scared stiff. We made it back to the field where Jim Evenden was waiting. By that time the storm was real bad. The pilot taxied the plane up to the fence where we jumped out and with the help of Jim hung onto the plane and the fence to keep the plane on the ground until the storm let up. The pilot was Nick Mammer who later became a famous aviator in the region and one of the first mail and airline pilots in our area.[66]

From the Bureau of Entomology directory for Portland, Oregon, 1930:

U.S. Entomological Laboratory (cooperation with Federal Forest Service, National Park Service, and Office of Indian Affairs, and with organizations of private owners of forest land).—Located at 501 Lewis Building, within walking distance of street cars. Investigations of the western pine beetle, the mountain pine beetle, the hemlock looper, and the hemlock bud moth and methods for their control. F.P. Keen, entomologist in charge.[67]

1931:

Figure 37. *Hisso Standard J-1. Photo courtesy U.S. Air Force.*

In 1931, F.P. Keen and C.S. Cowan, Chief Fire Warden of the Washington Forest Fire Association, conducted the first recorded aerial survey in Washington and Oregon, delineating hemlock looper defoliation in Pacific County, Washington. 230,000 acres were aerially surveyed in a Hisso Standard (Figure 37) aircraft; 4.0 flying hours (Wear and Buckhorn 1955).

From Eaton 1942:

Miller (1931) and Salman attempted a reconnaissance flight in an open-cockpit Forest Service biplane over the Tahoe, Eastern Plumas, and Lasson National Forests. Rough air conditions, poor visibility and lack of familiarity of the observers with the terrain made the survey quite unsatisfactory. Since only four hours of contract-flying time were available the attempt was not repeated. During the same year, the cooperation of entomologists at the Portland, Oregon, Forest Insect Laboratory was enlisted in an airplane dusting project undertaken by the State of Washington and the Weyerhaeuser

[66]Furniss, M. M.; Renkin, R. 2003. Forest entomology in Yellowstone National Park - 1922-1957. A time of discovery and learning to let live. American. Entomologist. 49(4):198-209.

[67]Bureau of Entomology directory of field activities. July 1930. p. 32.

Timber Company to control the hemlock looper in Southwestern Washington (Goodyear 1931; Keen 1931). An aerial survey was made prior to the treatment, and a series of vertical photographs were taken which were converted into a mosaic map covering about 40 square miles. The pictures proved disappointing in that the defoliated trees were indistinguishable from those that were not attacked.[68]

1932:

Figure 37a. *W.J. Buckhorn examining field cage on ponderosa pine. Prineville, OR. May 27, 1932. Photo by F.P. Keen. USFS Portland Station Collection, PS-125.*

In 1932, Pacific and Grays Harbor Counties, WA, 460,000 acres were surveyed by Bureau of Entomology and Washington State Department of Forestry in a Hisso Standard (Figure 37) aircraft; 7.0 flying hours (Wear and Buckhorn 1955).

[68]Eaton, C.B. 1942. The adaptation of aerial methods to the forest loss survey. Berkeley, CA: USDA Bureau of Entomology and Plant Quarantine. 20p.

1933:

Figure 37b. *The new Federal Court House at S.W. 6th Avenue and S.W. Main Street in Portland, Oregon, c.1933. Photo courtesy General Services Administration.*

On July 1, 1933[69], both the Bureau of Entomology, Division of Forest Insect Investigations and the Pacific Northwest Forest Experiment Station moved their offices into the new Federal Courthouse at S.W. 6th Avenue and S.W. Main Street, Portland, Oregon.[70] Their offices were located here until 1954 (see Appendix 2).

A National Plan for American Forestry, included a chapter by the Division of Forest Insects, Bureau of Entomology, with a section that outlined agency duties and terms of cooperation between the Bureau and other federal agencies in insect detection and control. The responsibility for conducting surveys remained with BoE. In 1933 'survey' applies to ground surveys. Again, staffing limitations were emphasized:

Cooperation between the Bureau of Entomology and Other Federal Agencies in Insect Control

It has already been pointed out that forest insect control involves many technicalities based on an intimate knowledge of the habits of the specific insect causing the damage. It likewise involves a detailed knowledge of the topography of the lands under control as well as close contacts with local labor and transportation facilities, which information is only available to the administrative officers on the ground. Due to this combined requirement for technical, entomological, and administrative knowledge, cooperation has been a necessary essential in all past control work.

[69]Prior to 1976, the federal Fiscal Year began on July 1 and ran through June 30.

[70]The Federal Courthouse was renamed the Gus J. Solomon US Courthouse in 1989.

The responsibility for the investigation of insects affecting forests or, in other words, the discovery of the biological fact on which control rests has been invested by law into the Bureau of Entomology. This law further provides for cooperation of the BoE with other Federal agencies charged with the protection of Government lands and with private timberland owners. Briefly, the instructions state that the BoE shall be responsible for conducting surveys and for giving specific recommendations for control at the request of other Federal agencies and for the assignment of an entomologist to the project during the period of control when conditions warrant. In action practice of the spirit of cooperation has exceeded the letter of the law. The Forest Service and National Park Service, as well as private owners, have aided the BoE by supplying field expenses or part of the salaries of entomologists engaged in control and the BoE has, from time to time, particularly in the case of the National Park Service, assumed more than its share of administrative duties. The chief handicap to the more successful conduct of such cooperation has been the lack of trained personnel in the Bureau of Entomology.[71]

1934:

BoE became BEPQ: The Bureau of Entomology and the Bureau of Plant Quarantine were consolidated with the disease control and eradication functions of Bureau of Plant Industry, to create the new Bureau of Entomology and Plant Quarantine (BEPQ).[72] Effective July 1, 1934, by the Agricultural Appropriation Act (48 Stat. 486), March 26, 1934.

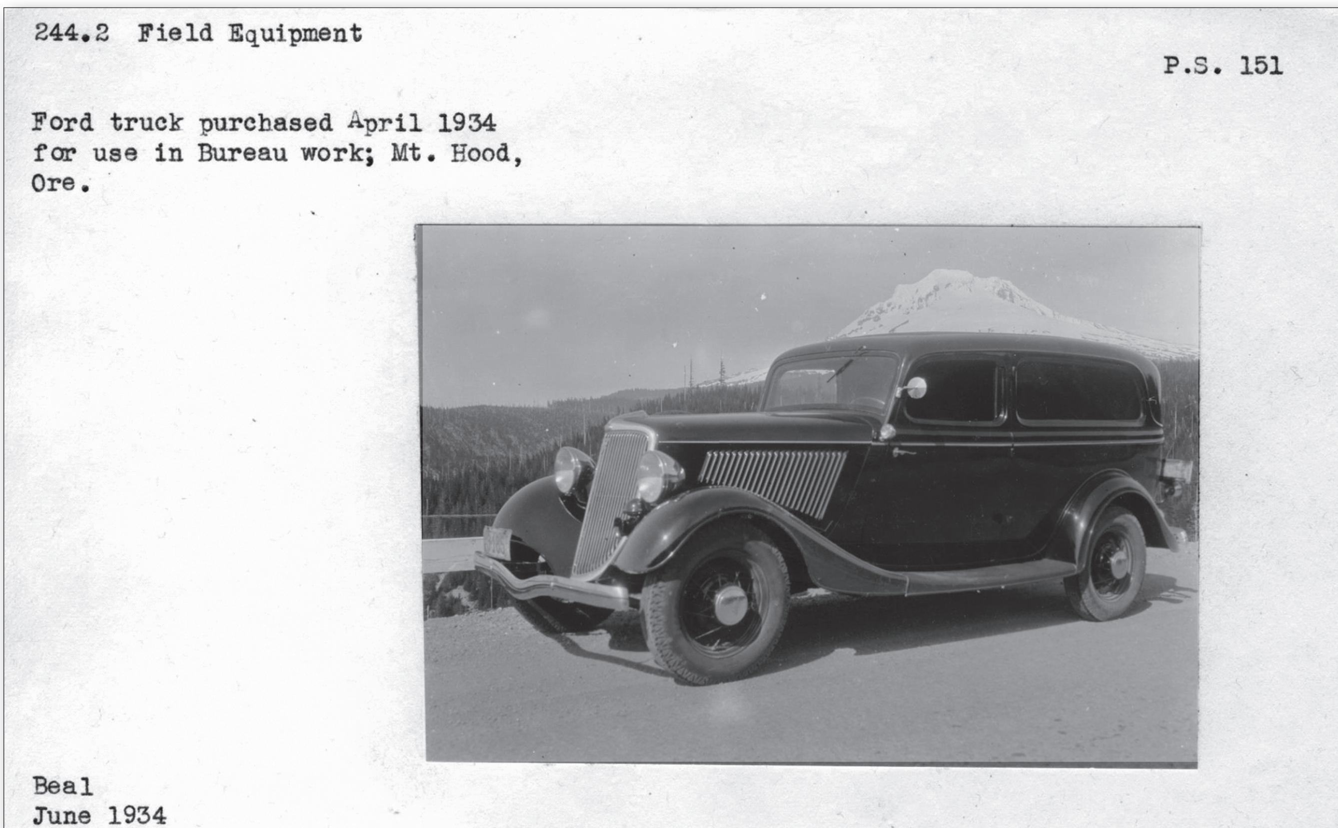


Figure 37c. *Ford truck purchased April 1934 for use in Bureau work; Mt. Hood, OR. (Note: Mt. Hood, OR is a town near Parkdale, OR; the mountain in the background is Mt. Adams.) June 1934. Photo by Beal. USFS Portland Station Collection, PS-151.*

[71]USDA, FS. 1933. A national plan for American forestry. The report of the Forest Service of the Agricultural Department on the forest problem of the United States. Letter from the Secretary of Agriculture transmitting in response to S. Res. 175 (Seventy-second Congress). 73rd Congress, 1st Session. Senate document No. 12. In two volumes. Volume 1. p. 728.

[72]Only the forest tree disease control and eradication functions of BPI were transferred to BEPQ in 1934; forest tree disease research continued within BPI until 1953.

From Cowlin 1988:

Robert L. Furniss joined the forest entomology staff late in 1934; other members of the staff were Keen, Beal and Buckhorn. At that time the Entomology group were establishing a series of sample plots in the pine region to evaluate trends in mortality loss from beetle attacks.[73]

1935:

A Regional Beetle Inventory in Pine.

The first general pine beetle [ground] survey of Oregon and Washington ever undertaken was started early in August with an organization of 15 men. Five crews of three men each experienced in western pine beetle spotting and control work will cover the major ponderosa pine areas by September 30. One crew each is working under direction of Supervisors of Malheur, Ochoco, Fremont, and Deschutes and one is at large. Chief purpose of the survey is to define the boundaries of the larger pine beetle infestations, to estimate the extent of beetle losses, and to get some information on the present trend of these beetle losses. The immediate use of the information is to give the basis for locating the ECW [Emergency Conservation Work Program; Civilian Conservation Corps - CCC] and the ERA [Emergency Relief Act] insect control work in Oregon and Washington for the period October 1, 1935 to June 1, 1936 on both National Forest and private lands. The present importance of the beetle problem in ponderosa pine stands of Oregon and Washington is indicated by the fact that during the four-year period 1931-1934, nearly four billion board feet of ponderosa pine timber were killed by the western pine beetle in Oregon and Washington. A.J. Jaenicke[74]

1936:

Figure 38. *Portland Conference June 13, 1936. Back row, left to right: W.J. Buckhorn (Portland, OR), F.C. Craighead (Chief BEPQ, Washington DC), A.J. Jaenicke (USFS Portland, OR), J.M. Miller (Berkeley, CA), F.P. Keen (Portland, OR). Front Row, left to right: J.C. Evenden (Coeur d'Alene, ID), J.A. Beal (Fort Collins, CO), R.L. Furniss (Portland, OR). (Note: All but Jaenicke are BEPQ.) USFS Portland Station Collection, PS-327.*

[73]Cowlin, R.W. 1988. Federal forest research in the Pacific Northwest. The Pacific Northwest Research Station. October 1988. p. 54.

[74]Jaenicke, A.J. September 1935. Six-twenty-six. USFS.

1941:

From Eaton 1942:

> *In 1941 G.R. Struble and Ranger Munhall (see Miller 1941) flew over the Mariposa District of the Sierra Nevada in a two-seated cabin plane. The flight was made at an elevation of 2,000 feet above the ground level. The observers made independent counts of the insect-killed trees; on tallied trees seen, and the other spotted trees on a map. A comparison of the two methods showed that one observer had seen half again as many trees as had the other. In spite of good visibility, ability to maintain the desired elevation and good working conditions, the speed of the plane (80-90 miles per hour) was too great to be satisfactory.*[75]

1942:

The BEPQ was administratively transferred to the newly-formed USDA Agricultural Research Administration.

F.P. Keen left the Portland lab to replace J.M. Miller at the Berkeley lab on November 6, 1942. Robert L. Furniss succeeded Keen in charge of the lab at Portland.

From Eaton 1942:

> *The chief difficulty experienced in past air survey trials in this region [California] has resulted from the inability of the entomologists to have access to the plane for a long enough time to determine the most advantageous use of it. The planes have been supplied by other agencies under conditions which have permitted the entomologists little more than a ride over the forest. In short, it has not been possible to plan a test program that would definitely answer whether or not aerial methods could be used for measurement of loss.*[76]

1944:

Figure 39. *BT-13 Valiant. Photo courtesy U.S. Air Force.*

Figure 40. *Grumman Widgeon. Photo courtesy of James W. Harvey.*

In northwestern Washington and northwestern Oregon 1,560,000 acres were aerially surveyed by BEPQ personnel in a BT-13 (Figure 39) and DC-3 in Oregon, and a Grumman Widgeon (Figure 40) aircraft in Washington, for a total of 6.5 hours flying time (Wear and Buckhorn 1955).

[75]Eaton, C.B. 1942. The adaptation of aerial methods to the forest loss survey. Berkeley, CA: USDA Bureau of Entomology and Plant Quarantine. 20p.

[76]Ibid.

1945:

In northwestern Oregon and southwestern Washington, 550,000 acres were aerially surveyed by BEPQ and Crown Zellerbach Company personnel in a Fairchild aircraft, for a total of 11.0 flying hours (Wear and Buckhorn 1955).

Figure 41. *Loaded WACO aircraft over hemlock looper area, Clatsop County. July 7, 1945. USFS Portland Station Collection, PS-689.*

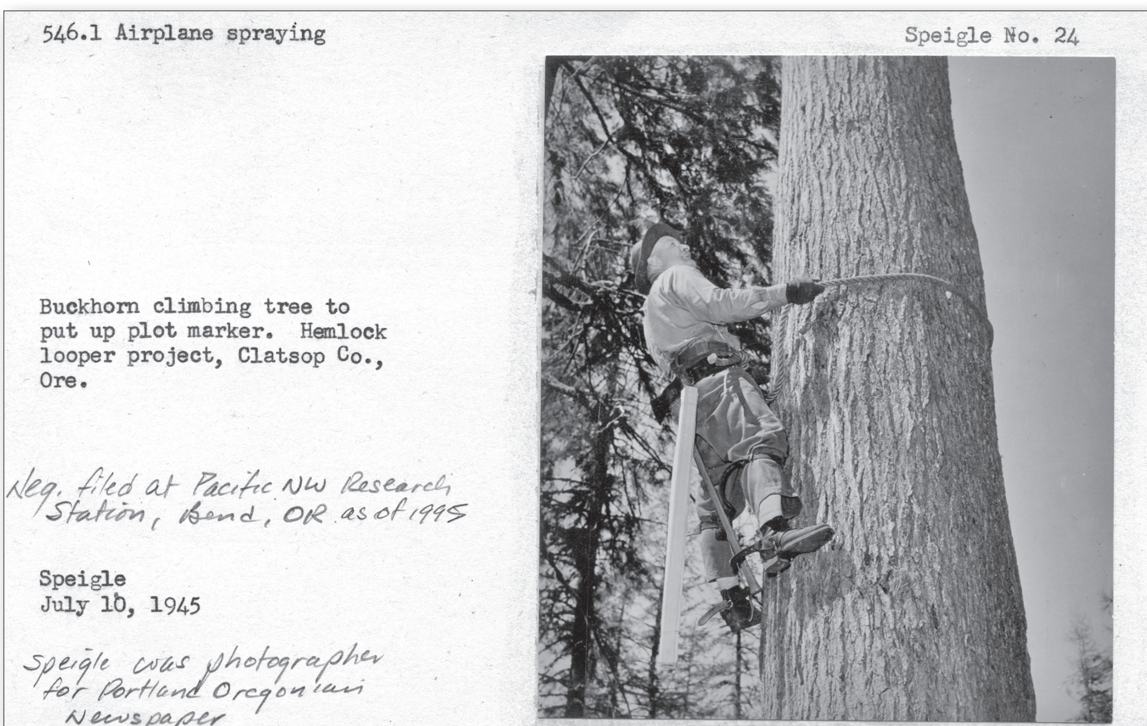


Figure 42. *Buckhorn climbing tree to put up plot marker. Hemlock looper spray project, Clatsop County, Oregon, July 10, 1945. Spiegle-24. Courtesy WFIWC archives.*

Figure 43. *Walter J. Buckhorn and Robert L. Furniss counting dead hemlock loopers, 1945. USFS Portland Station Collection, Spiegle-22.*

From Wickman et al. 2002:

> *In 1945, the hemlock looper again became destructive, this time in Clatsop County, Oregon. Part of this infestation was dusted with DDT by airplane, marking the first such use of this insecticide in a west-coast forest. Stewart Holbrook, a well-known Portland author, described the result (Portland Oregonian, 26 August 1945) under the heading "DDT: Atomic Bomb for Parasites of the Forest. Miracle Chemical Spells Sudden Death for Insects, Knocks the Hemlock Looper for a Loop in Dusting of Oregon's Woods."*
>
> *He noted that the extent of the infestation had been surveyed by Robert Furniss: "In this tall forest, its ground a jungle, a hundred men on foot could not learn the damaged area in a year's time ... So Furniss got into a plane and for the next few weeks ... (looked) for the brown (infested) areas, and mapped the infestation.*[77]

From a 1977 interview with Robert L. Furniss (RLF), conducted by R.C. Larson (RCL) about the hemlock looper project:

> *RCL: I'd like to get a little more history on dusting and spraying.*
>
> *RLF: Well, dusting went out with the hemlock looper project in the thirties. From then on, it was spraying. Our first experience with spraying DDT was in Clatsop County, Oregon, against the hemlock looper [1945]. During the war years there was a severe local outbreak of the hemlock looper, principally on Crown Zellerbach land. Trees of all ages were being*

[77]Wickman, B.E.; Torgersen, T.R.; Furniss, M.M. 2002. Photographic images and history of forest insect investigations on the Pacific Slope, 1903-1954. Part 2. Oregon and Washington. American Entomologist. 48(3):178-185.

killed over a considerable area, and it occurred to us that about the only thing that could be done to save this timber would be to aerially spray it. Calcium arsenate dust had been applied previously against the hemlock looper in Pacific County, Washington, in the early thirties. But this material was expensive to apply and created some problems. The people of the city of Seaside were very reluctant to have arsenic sprayed on their watershed. They had heard about DDT, which the Army was using for insect control in the South Pacific and other places, and suggested that we try to get some of this material released for our use on the city of Seaside watershed. We agreed to approach the Army on this, and were successful in getting this material. We did use a little lead arsenate on some adjacent areas, but on the main watershed, they wouldn't agree to this.[78]

1946:

R.L. Furniss conducted the first systematic aerial survey in Alaska. From Furniss 2011:

[Robert L.] Furniss went to Kosciusko Island [Alaska] again November 9-27, 1946. He and [Ranger Ivan H.] Jones undertook the first systematic aerial survey of insect damage in Alaska November 17. They flew along section lines sketching the location of dead and reddened spruce trees on forest type maps at a scale of four inches to the mile. The airplane was a Bellanca pontoon monoplane flying at about 90 mph.[79]

From the *Forest Service Program for 1946 and the Years Ahead*:

We are convinced that more effective protection against forest insects and diseases is essential. The Bureau of Entomology and Plant Quarantine and the Forest Service are again urging new legislation consistent with the recommendation to the Joint Committee on Forestry in 1940 that will declare federal responsibility in nationwide protection, broaden existing authority, and provide for more prompt and adequate action to suppress incipient epidemics and to overcome epidemics that do get in the way. The proposal provides for cooperation with the states and private agencies.[80]

[78] Larson, R.C. 1977. Western forest entomology history: an oral history interview with Robert L. Furniss. October 14, 1977. Portland, OR. Durham, NC: Forest History Society. p. 12.

[79] Furniss, M.M. 2011. Beginnings of forest entomology in Alaska: A spruce beetle outbreak on Kosciusko Island sets the stage, 1946. SourDough Notes, fall 2011 p. 10-11. Regional eMagazine. Juneau, AK: USDA Forest Service, Alaska Region, Public Affairs and Communications Office. http://www.fs.usda.gov/r10

[80] Marsh, R.E. 1946. Forest Service program for 1946 and the years ahead. Journal of Forestry. 44(3):188.

Chapter 4
The survey begins in the Bureau of Entomology and Plant Quarantine – 1947-1953

Federal administrative survey responsibility: USDA Agricultural Research Administration, Bureau of Entomology and Plant Quarantine, Forest Insect Investigations

From 1947-1953, the Portland Forest Insect Investigations staff administratively resided within the Agricultural Research Administration, Bureau of Entomology and Plant Quarantine. Their office was located in the U.S. Courthouse at SW 6th and Main, on the 4th floor in room 445; R.L. Furniss in charge. (See Appendix 2.)

Years of work by many organizations came to fruition in June 1947 with passage of the Cooperative Forest Pest Control Act…

> *In 1947, the passage of Public Law No. 110, the Cooperative Forest Pest Control Act, brought the culmination of long effort to work out forest insect control on a cooperative basis with landowners, states, and federal agencies participating. This problem had been kept alive in the annual conferences of the Western Forestry and Conservation Association and a solution sought as the problem of curbing new insect plagues which confronted forest managers became more important each year. This act designed to do for cooperative forest insect control what the Clarke-McNary Act has accomplished for cooperative forest fire protection, by assuming federal responsibility for a share in the battle against forest insect losses, long recognized through research and survey as many times greater than the losses by fire in the forests of the nation.*[81]

… which provided the federal funds needed to support an aerial insect and disease detection survey:

> **Forest Pest Control Act of 1947 (61 Stat. 177; Public Law 110), June 25, 1947.**
>
> *This act authorizes the Secretary of Agriculture to use Federal funds to conduct surveys to detect and evaluate forest insect and disease outbreaks and to prevent, retard, control, suppress, or eradicate injurious forest insect pests and tree diseases on all forest lands in cooperation with Federal land-managing agencies, the States and private owners of forest land. The Secretary of Agriculture has delegated to the Forest Service the responsibility for carrying out the provisions of these acts. (For full text, see Appendix 3.3.1.)*

With this funding, the concept of a regional aerial survey finally became a reality. While state, private and federal forest land managers were united in their desire to detect and map insect activity on their lands, the responsibility for the surveys and distributing maps and data reports remained with the small BEPQ Forest Insect Investigations staff. Knowledge gained during the aerial experiments of the preceding decades helped to quickly establish aerial survey procedures and techniques.

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[81]WFCA. 1949. Forty years of western forestry, a history of the movement to conserve forest resources by cooperative effort 1909-1949. Portland, OR: Western Forestry and Conservation Association. p. 59.

The Northwest Forest Pest Action Council, the primary advisory body for survey and control operations in the Pacific Northwest, became operational within a year of the 1947 funding. The goals to salvage, control, and eliminate forest insect depredations inspired unanimous voluntary cooperation between state, private, and federal participants. Aerial detection maps played a crucial role in these efforts. Between the BEPQ's expertise and leadership and the cooperative voluntary participation organized through the Northwest Forest Pest Action Council, these early-year surveys appear to have happened almost effortlessly.

The following accounts, by year, include details from a variety of sources and demonstrate how quickly the increasingly complex early aerial survey program evolved, who the players were, and how the surveys were accomplished. They also show how closely (both functionally and financially) the early aerial surveys were tied to the region's co-evolving aerial control program; both employed surplus World War II equipment, pilots, and methodologies.

1947:

Figure 44. *N3N-3 airplane with pilots Wear and Hessig. Lower wing blocking view forward and down. December 23, 1948. Photo by C.W. Getzendaner. USFS Portland Station Collection, PS-786.*

A brief overview the R6 aerial survey's evolution, from a 1977 interview with R.L. Furniss (RLF) conducted by R.C. Larson (RCL):

RCL: Can you tell me about the regional surveys in the Northwest?

RLF: Well, yes, they started out … with the pine beetle [ground] survey plots. Forest by forest, there were estimates of the annual losses or kills … And then as time went along, we became aware of the… effects of things like defoliators. It became evident that we needed means of locating these outbreaks, and particularly after we had a means of combating by aerial spraying. So, how to do this? We had Buckhorn who was a flyer, and very much interested in the use of airplanes.

Together, I guess, we devised the concept of aerial surveys of this area. First, we got flights with whomever we could, sometimes the Marines, sometimes the Coast Guard, sometimes, well, everything. The survey was done by an aerial observer with a map. And you have to fly low. So we developed this concept, and by that time Keen had gone down to

California and I was in charge. That was in the 1940s. Gradually this concept of regional surveys was developed. [This paragraph inserted from p. 11.]

[Then] for a period of time we contracted planes and got them from different sources and began to cover more of the two states. By that time, the Pest Action Council was in operation and so this information was gathered on maps and presented to their annual meeting, which had representatives of the various agencies and [private land] owners. We could point out where the problems lay and then the organizations could do what they felt should be done.

Well, then it became evident that we needed our own equipment, that contracting was not sufficient, so in 1947 we recruited a young man, a former Navy flyer, John F. Wear … and we got a surplus plane … he flew it out and we used that airplane on the annual survey.[82]

In June 1947, John F. Wear – a forestry graduate from the University of Michigan and former naval aviator, flew the N3N-3 Navy surplus biplane (Figures 44 and 45) from Orlando, Florida to Portland, Oregon. Wear's account of the flight:

I flew the old N3N biplane (a US Navy trainer type I learned to fly in 1943) from Orlando, Florida to Portland, OR in June 1947. The N3N had a 50 gallon tank mounted in the front seat and a complete array of spray booms attached under the lower wings. The 'drag' kept maximum airspeed to about 65 mph. The old N3N engine used a gallon of oil per hour, so I had to land for gas and oil frequently. Took 13 days to fly from Orlando to Portland because of weather, headwinds, and frequent stops.

The N3N was arranged for by B.E.P.Q (Bur. of Ent. and Plant Quarantine) with Forest Insects, Truck Crop Insects, and Insect Affecting Man and Animals footing the bill. Sprayed experimental insecticides on pea crops in eastern OR and WA for pea aphid control in late June and early July. Flew 10 ft. above peas down to 1 ft. (frequently rolling the airplane wheels in the peas because of poor forward visibility). In late July, flew different insecticides in western OR for controlling vetch bruchid insect in vetch crops. Crop spraying is by far the most dangerous flying anyone can do!

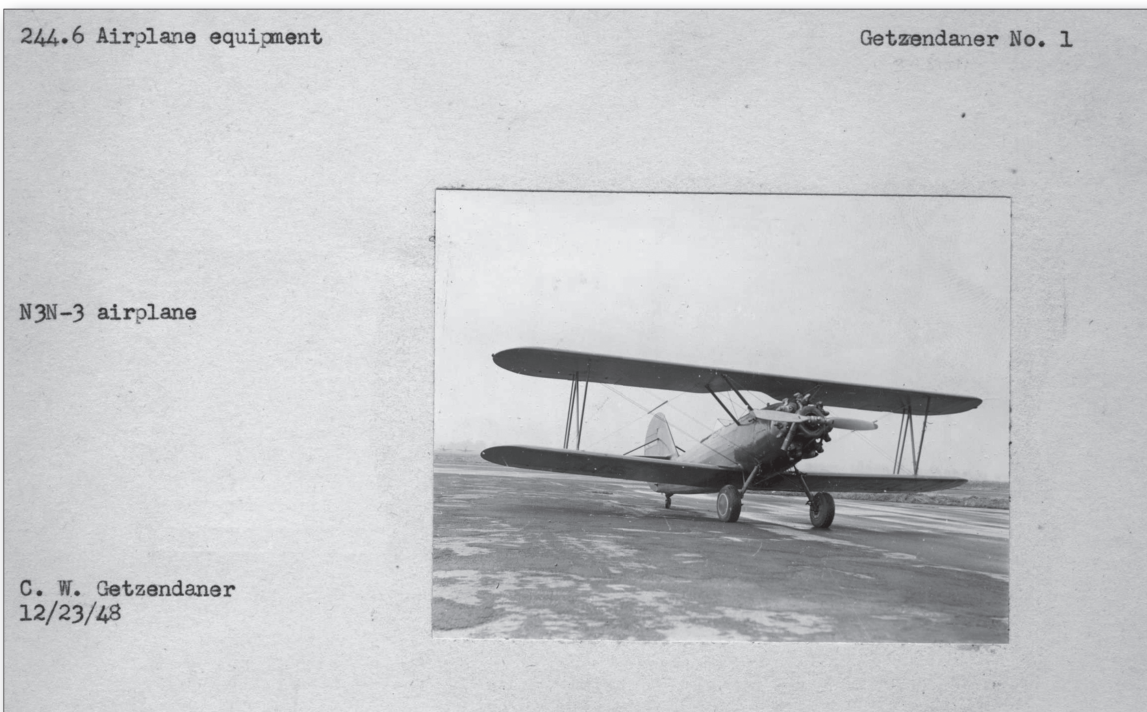


Figure 45. *N3N-3 airplane. December 23, 1948. Photo by C.W. Getzendaner. USFS Portland Station Collection, Getzendaner-1.*

[82]Larson, R.C. 1977. Western forest entomology history: an oral history interview with Robert L. Furniss. October 14, 1977. Portland, OR. Durham, NC: Forest History Society. p. 11 and 15.

> *Removed all spraying tanks and booms from the N3N and Buck and I began the first aerial survey in the Blue Mtns in August (OR and WA). Buck flew in the front seat for best visibility (never good with the large radial engine in front of you) and sketchmapped any damage on F.S. ¼" scale maps. We experimented with various altitudes above terrain, tried grid vs. contour coverage and different strip widths for relative accuracy. Defoliation damage mapping required lower altitudes. After a couple seasons we generally accepted 500 feet above terrain and 3 mile flight strips in relative flat terrain and contour flying in drainages in dissected terrain. Always spent considerable time ground checking to improve accuracy in damage intensity and location.*[83]

Walter Buckhorn and John Wear worked together for the next 14 years establishing and enhancing aerial survey protocols and techniques. A few more insights into their early survey years are best illustrated in Furniss 2000:

> *Once, at a makeshift airstrip, the tie-down ropes broke while the engine was warming, and the plane chewed into their vehicle, bending the propeller. They drove to Seattle to have it straightened; then, Buck installed it and they resumed the survey.*
>
> *Buck and Wear often slept in sleeping bags under the wings of the plane. Buck drove a panel truck between airstrips so that, on bad flying days, they could ground-check the accuracy of their aerial observations. They flew out of meadows or roadways and occasionally had to chase off cows. Their "per diem" was $4.00 per day, affording a motel and hot showers once or twice a week and a restaurant meal every few days.*
>
> *Surprisingly, Buck was very susceptible to air sickness and never got over it. With a paper bag handy, he would sketch-map insect-caused tree damage until noon, eat lunch, rest, then fly for another hour, during which he got sick again. At day's end, he drank grapefruit juice and went immediately to bed. After a good breakfast next morning, he was in the air again.*
>
> *By 1949, all of the 49 million acres of coniferous forests in Oregon and Washington were being surveyed aerially for infestations of defoliators and bark beetles. In 1953, Buckhorn and Wear, alone, covered 47.5 million acres. That year they mapped 1,860 centers of infestation involving 8.5 million acres of forest.*
>
> *Large-scale salvage logging operations and aerial spraying were based, in large part, on Buckhorn's observations and maps. For example, 3.25 million acres of forest infested with western spruce budworm,* Choristoneura occidentalis Freeman *(*Lepidoptera: Tortricidae*), were sprayed from 1949 to 1953 at a cost of approximately $3,900,000. The location of the infested areas to be sprayed was provided by Buck's maps.*
>
> *Buck had good reason to be proud of his accomplishments on the aerial surveys. His skill and accuracy had set the standard. Neither airsickness nor the ever-present danger involved in flying at low altitudes over mountainous terrain had deterred him.*[84]

For a comprehensive review of Buck's life and many accomplishments, see Furniss 2000.

The first surveys of 1947 were actually conducted prior to the passage of the Forest Pest Control Act and prior to John F. Wear's employment.

In the fall of 1946, an outbreak of Douglas-fir tussock moth had been detected on the Umatilla NF near Troy, OR, and a suppression project for the spring of 1947 was under consideration. So, an aerial survey was planned to determine the extent and severity of the outbreak. On March 24 and 25, 1947 the first two surveys (of 11 that year) were made. This account is from Walter J. Buckhorn's April 10, 1947 report:

[83]From a letter written by J.F. Wear to M.M. Furniss. Courtesy of M.M. Furniss and the Western Forest Insect Work Conference archives.

[84]Furniss, M.M. 2000. Walter Julius Buckhorn (1899-1968)—legendary forest entomologist, not of the classroom kind. American Entomologist. 46(3):133-140.

Aerial Survey Details

The aerial survey was made on March 24 and 25 with Forest Service pilot Larry J. Sohler at the controls. Ranger Willis W. Ward acted as navigator on March 24 and the writer [Walter J. Buckhorn] acted as mapper and observer on both days. The airplane used was a Stinson Voyager on loan from the Division of Fire Control of the Forest Service. This 4-place, high-wing monoplane was generally suitable for the work, except that the cruising speed of 110 miles per hour was somewhat too fast for best results.

After several days' delay due to adverse weather conditions, the takeoff was made at 9:05 AM, Monday March 24, from the Portland Municipal Airport. Martin's Airport at Walla Walla, Washington was reached two hours later. There Ranger Willis Ward, upon whose district the infestation is located, joined the party. The takeoff for the infested area, about 35 miles distant, was at 12:40 PM. Although there was a high overcast, visibility of the timber was good. Nine runs, from 6 to 20 miles in length and at elevations ranging from 1,000 to 1,800 feet above the trees were made over the stands on the Umatilla National Forest and the adjoining Wallowa National Forest that were suspected of harboring tussock moth infestation. These runs were flown at two-mile intervals and in an east-west direction. The last run was extended some 35 miles to the east for general scouting on the Wallowa. Turbulent air conditions caused by the tremendous canyons and gorges were encountered over much of the area. The return to Walla Walla was at 3 PM.

Soon after the survey got under way, it was realized that the larch, being bare of needles, presented a serious problem in the recognition of the defoliated fir. The magnitude of this problem is indicated by the fact that larch, Douglas fir, and white fir are about equally represented in the area of infestation. At the time of the survey the larch appeared as grey to brown streaks and patches in the general green canopy of the forest. The same was true of the defoliated firs, for the partially consumed needles that gave the defoliated trees a reddish-brown cast last fall had fallen during the winter, leaving the firs with a greyish brown appearance. At the altitudes flown there were practically no tangible characters for separating the larch from the completely defoliated fir. Only the partially defoliated trees could be relied upon to indicate the extent of infestation. Even such trees could not be wholly depended upon, for many of the white firs still retained cones in the top and consequently appeared to be partially defoliated. Despite these difficulties and some few uncertainties a good idea of the general extent and intensity of infestation was obtained. A relatively small amount of ground work should be sufficient to provide all the supplemental information that is needed.

During the course of the flight the extent and intensity of infestation was sketched on a 1/2-inch-to-the-mile type map previously prepared for the purpose.

Because of the difficulties resulting from the prevalence of the larch, it was decided to make an additional flight over the area on Tuesday, March 25, and to fly closer to the tree tops. Ranger Ward, having other duties, was unable to make this second flight. With the lighter load, Pilot Sohler deemed it safe to fly much lower than on the first day and at times operated the plane within 200 feet of the trees. This low flying proved to be of no advantage because the trees passed too rapidly and too close at hand to permit determination of the species. Very little additional information on the extent of the infestation was obtained. In view of the existing conditions, it was felt that not much would be gained from additional flights. The return to Portland was completed at 1:10 PM after a two-hour flight from Walla Walla.

The total flying time for the project was 7 hours and 50 minutes. Of this time, 3 hours and 50 minutes were required for the actual survey.
...
For future reference, it is recommended that aerial reconnaissance for the detection or delineation of defoliator outbreaks be made in the fall whenever stands of larch are involved.

On the area of known defoliation by the tussock moth (Figure 46), heavy defoliation in patches is scattered over some 1,265 acres; moderate defoliation occurs on 23,890 acres; and light defoliation occurs on 30,910 acres. In all, about 56,065 acres supporting 140 million board feet of Douglas-fir and white fir are infested to some degree. Approximately 50 percent of this acreage supports 65 percent of the total susceptible volume and practically 100 percent of the accessible volume that warrants protection. It should be recognized that these acreage figures are tentative and that further groundwork may show that they should be revised, either upward or downward. However, it is felt that they are reasonably accurate.[85]

[85] Buckhorn, W.J. 1947. Second memorandum on the Douglas-fir tussock moth outbreak near Troy, Oregon. 10 p.

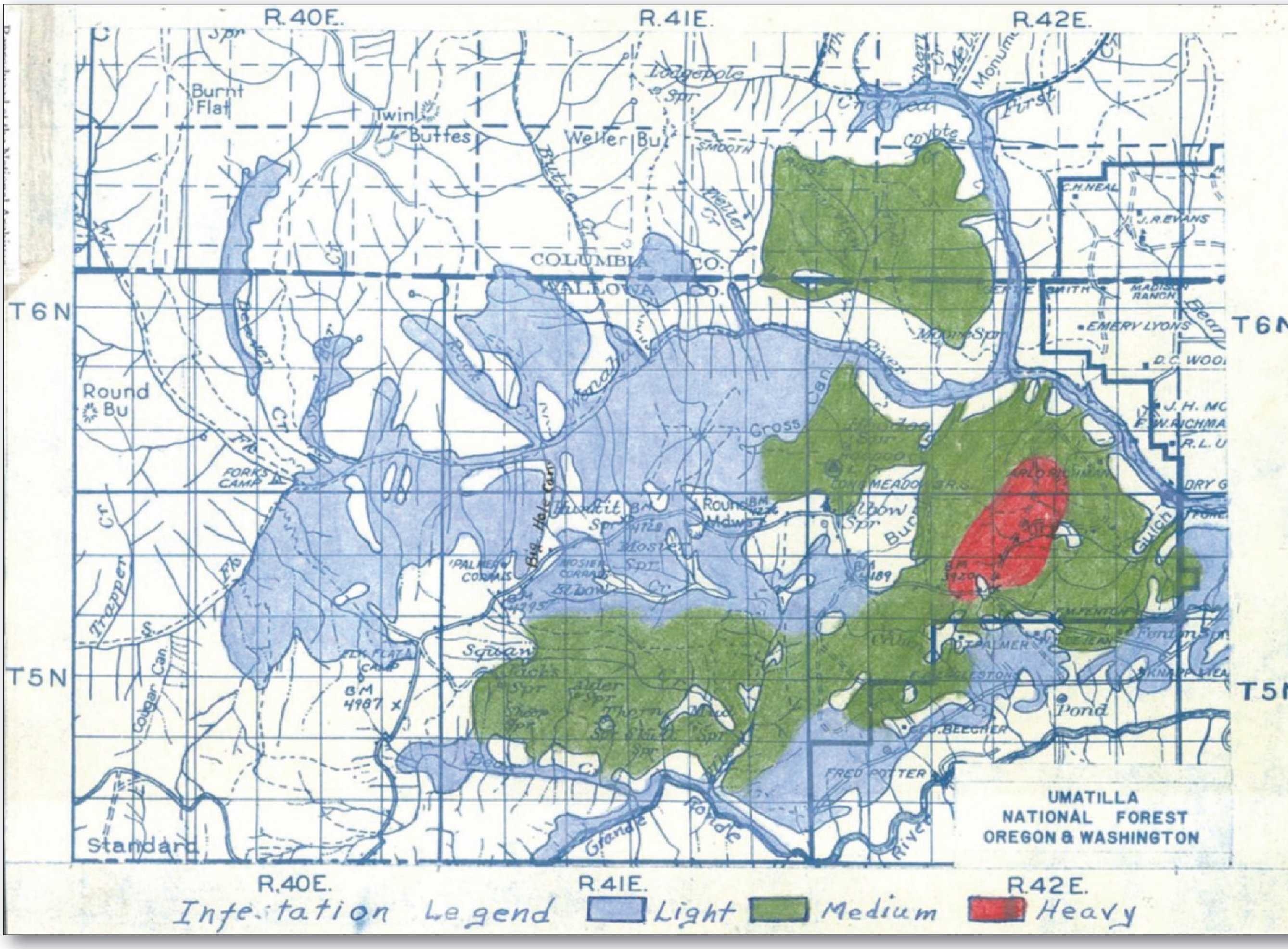


Figure 46. *Aerially mapped tussock moth defoliation on the Umatilla National Forest, 1947. Source: Second memorandum on the Douglas-fir tussock moth outbreak near Troy, Oregon by W.J. Buckhorn, 1947.*

From the final summary report for all 11 of the 1947 aerial surveys:

March 24-25, 1947: Stinson Voyager – Umatilla NF
May 6, 1947: Ercoupe – Umatilla NF
August 19, 1947: N3N-3 – Umatilla NF, Wallowa NF
August 21, 1947: N3N-3- Umatilla NF and Whitman NF
August 23, 1947: N3N-3 – Wallowa NF and Whitman NF
August 24, 1947: N3N-3 – Umatilla NF and Whitman NF
September 8, 1947: Stinson Voyager – Umatilla NF and Malheur NF
September 9, 1947: Stinson Voyager – Malheur NF
September 10, 1947: Stinson Voyager – Malheur NF and Whitman NF
September 11, 1947: Stinson Voyager – Ochoco NF

Introduction

Early in the spring of 1947 control of a tussock moth outbreak on the Umatilla National Forest near Troy, Oregon was being considered. The outbreak had been discovered but not delineated in the fall of 1946; hence information as to the extent and intensity of the outbreak was needed. The only feasible way to obtain the desired information in time to be of use was to make an aerial survey.

On March 24 and 25 and aerial survey was made in a Forest Service airplane piloted by L.J. Sohler. Buckhorn mapped the infestation and District Ranger W.W. Ward acted as observer. Delineation of the defoliated stands was difficult because

of the prevalence of larch which was bare of foliage and closely resembled defoliated fir. The principle area of infestation was mapped from the air and later in the season checked on the ground. Control was undertaken on some 14,000 acres of heavily infested, merchantably valuable timber. Some 41,000 acres were excluded as being non-merchantable or too lightly infested to warrant control.

As the season progressed the tussock moth infestation in the sprayed stands developed to a greater extent than had been anticipated. Defoliation of moderately heavy intensity became prevalent. Also, a small area of infestation was discovered some eight miles to the south, near Promise, Oregon. Reports began to come in regarding suspected centers of tussock moth infestation which proved to be outbreaks of the spruce budworm.

These events posed several problems. Information as to the regional extent and status of tussock moth infestation was needed in order to determine whether artificial control would be necessary in 1948. Extensive defoliation by the spruce budworm complicated the detection of outbreaks by the tussock moth. Furthermore, the budworm situation itself was in need of clarification, both as to the location of affected stands and the amount of damage being done.

In order to obtain the needed information, it was decided to make an aerial survey of the 7,755,000 timbered acres of the Blue Mountain region, and to make supplementary ground surveys in the Blue Mountains and elsewhere. Most of the survey work for the year was done in August and September, but information regarding the defoliator outbreaks was collected intermittently during the entire period from March to October.

The aerial survey was the most comprehensive ever made in this region. It was a cooperative undertaking by the Forest Service and the Bureau of Entomology and Plant Quarantine. On the area covered it provided the basic information regarding the extent of infestation. It also provided valuable information regarding the usefulness of this type of survey for detecting insect-caused losses in general. This latter phase of the aerial survey will be covered separately in a report dealing with procedures. It may be stated here that aerial surveys are a definite step forward in the detection of forest insect outbreaks. They also make ground surveys more effective by directing them to critical areas without loss of time and effort.

The ground surveys were likewise conducted cooperatively by the Forest Service and the Bureau of Entomology and Plant Quarantine.
. . .
Recommendations

1. *No artificial control of the tussock moth is recommended for 1948.*
2. *Further biological studies of the tussock moth are proposed in order to determine the role of natural control factors in the declining phases of an outbreak.*
3. *No artificial control of the spruce budworm is recommended for 1948.*
4. *A study of the spruce budworm with special reference to its effects upon fir stands in Oregon and Washington is suggested.*
5. *A comprehensive survey of the defoliator situation throughout the region is recommended along the lines developed in 1947. Extension of the aerial survey to other areas is desirable and will be undertaken, funds permitting.*
6. *It is recommended that all foresters be on the alert for evidences of defoliator and other insect activity and that outbreaks, however small, be promptly reported.*[86]

This summary of the 1947 surveys appeared in a report to the Chief of the BEPQ:

Aerial Surveys Advance Forest-Insect Detection - *An aerial reconnaissance survey of 7,750,000 timbered acres in the Blue Mountains of Oregon and Washington was completed in 1947 at a cost far below that required for earlier ground surveys. About 710,000 acres of spruce budworm infestation, 70,000 acres of Douglas-fir tussock moth infestations, and several small outbreaks of other species were mapped, and the general status of the western pine beetle was recorded.*

[86]Buckhorn, W.J. 1948. Defoliation situation in the fir stands of eastern Oregon and Washington - season of 1947. Bureau of Entomology and Plant Quarantine, Forest Insect Laboratory. February 18, 1948. 11 p.

All this was done in about 30 hours of flying time – less than 2 weeks' work for obtaining information that would have taken a ground crew most of the summer to acquire. Clearly aerial surveys are a marked step forward in the field of forest-insect detection. Many details and procedures must still be worked out, however, before the method can be used for obtaining more than a general idea of infestation boundaries and general estimates of timber losses.[87]

By the end of 1947, annual aerial surveys in Oregon and Washington had been launched.

1948:

Figure 47. *Executive committee Northwest Forest Pest Action Council meeting with survey maps. 1959. Glascock, Furniss, Howard, Cornelius, Barnes, Bjorkland, Taylor, Kolbe. Photo by Wally C. Guy. USFS Portland Station Collection, PS-2672.*

By 1948, the focus moved from the Douglas-fir tussock moth to the western spruce budworm. Organized around this threat and casually formed in 1948 as the Spruce Budworm Action Committee, the Northwest Forest Pest Action Council (NFPAC) became the advisory group for aerial surveys. The strong council helped acquire funding and determine where to survey, salvage, and conduct control operations. Annual aerial survey maps and reports were primary decision-making resources for this group.

From Whiteside 1956:

Spruce Budworm Action Committee

By 1948 the budworm was so widely distributed and affected so many ownerships that no one organization could control it. Federal, State and private cooperation and financing were urgently needed.

[87]Report of the Chief of the Bureau of Entomology and Plant Quarantine 1948. USDA, Agricultural Research Administration. p. 25.

In the fall of 1948 representatives of all affected agencies, companies, and individuals met to consider survey findings and the pressing problem of spruce budworm control. A Spruce Budworm Action Committee was organized, which felt that control should be undertaken by administrative agencies existing in the two states. A control plan was prepared initiating action against centers of infestation that provided the greatest immediate threat to our timber resources. Similar meetings have been held each year and detailed control plans prepared for each annual project by this informal group, now called the Northwest Forest Pest Action Committee.[88]

William D. Hagenstein (who, at the time, represented the West Coast Lumberman's Association) recounted the Northwest Forest Pest Action Council's formation in a 1992 interview with Harold K. Steen:

The Northwest Forest Pest Action Council was organized by Hoss Andrews who was the regional forester in Portland in 1948, and he invited a handful of us. He invited the two state foresters. He invited Kolbe of the Western Pine Association, myself, and a representative for three or four of the major land owning companies like Weyerhaeuser and Crown-Zellerbach, which were the two biggest ones in our region, to get together to decide how we could handle … the spruce budworm. … We got together in the library in Portland. It wasn't called the Northwest Forest Pest Action Council, we called it the Spruce Budworm Action Committee; that was its original name. We immediately got to work deciding how we were going to find out the extent of the infestation … the Bureau of Entomology and Plant Quarantine's Division of Forest Insect Investigations … furnished airplanes and spotters. Several of the companies and the states of Oregon and Washington did the same thing. We went out and completely mapped the infestation area.

…

Ernie Kolbe was elected chairman of the Spruce Budworm Action Committee because the infestation was principally in the pine region. He was chairman of the Pest Action Council continually until he retired [1968]. Then we kept the thing alive. After the spruce budworm became moot as a problem, other things began to show up. In 1951 we had a hurricane that blew down about ten billion feet of timber in the region, and we changed the name of the committee from the Spruce Budworm Action Committee to the Northwest Forest Pest Action Council. We had a Douglas-fir beetle subcommittee of which I was the chairman … So when it was a Douglas-fir regional problem, why, I was generally made the chairman. If it were a pine region problem, Kolbe. But Kolbe stayed the chairman of the full council. We worked with the Forest Service, BLM, and with the industry and with the state forestry departments. We began to make a yearly insect detection survey of the whole area in the two states, all the lands. At a very low cost, you know, because the companies furnished planes and observers and the government did some, the states did some. We did a hell of a good job finding out where the problems were.

…

Here was one of the most cooperative things that ever occurred. There was no animosity by anybody on the regulation issue or any of these controversial things. Here our job was, we wanted to save the [timber] resource, and we got together like I never saw any group ever do in the history of the country. The Northwest Forest Pest Action Council history is a subject that would be a damn good book for somebody.

…

My own personal feeling is that it's one of the highlights of forestry in our region, what we accomplished with it, because it was good. It was a regional forester of the Forest Service [Hoss Andrews] who was the right kind of a guy to start a thing like that. He was the right personality.[89]

From R.C. Larson's (RCL) 1977 interview with R.L. Furniss (RLF):

RCL: Could you describe the Pest Action Council a bit, how it was formed, and its function?

RFL: The Pest Action Council developed in the early stages of the spruce budworm control program. … [but] we should talk about spruce budworm first.

…

We became aware of spruce budworm activity in the eastern part of the state [OR] and noted that infestations flared up and dropped out. No study was made, just recorded as having occurred. Finally, there was an outbreak that covered

[88]Whiteside, J.M. 1956. Spruce budworm control in Oregon and Washington 1949-1956. Portland, OR: USDA, PNFRES, Division of Forest Insect Research. p. 7.

[89]Steen, H.K. 1992. Forestry's advocate: William D. Hagenstein, oral history interview. October 1992. Durham, NC: Forest History Society. p. 75-78.

many hundreds of thousands of acres. When DDT became available and aerial application seemed possible, we didn't know whether it would be effective against the spruce budworm. So a project was set up on the Umatilla NF in 1948. Beal came out from Duke University and Charlie Eaton from the Berkeley California Lab. We set up an experiment. It worked.

Different types of ownerships were involved in the big outbreak. At that time the Pest Action Council movement was developed – Ernie Kolbe and Bill Hagenstein of the industry and Oscar Erikson of the Forest Service Timber Management and … the regional forester, Hoss Andrews, who was a key man. I would say the two principal people were Kolbe and Andrews. They conceived the idea of a cooperative approach.

…

This approach, considering the pest problem from all angles (administrator, researcher, and the public) judging its merits and what the alternatives are, and then doing the next stop of getting the support of the administrators, and appropriations from the legislature, were all things that this council movement took on. We operated by consensus and then we got into the fact that, well, we don't have enough information, we need more research. … It expanded the program into a truly cooperative, volunteer type of approach, as contrasted with an authoritarian, governmental type of thing. We had our own forum where we could disagree. If there was no consensus, this was a red flag indicating that maybe there isn't the preponderance of evidence necessary for a particular course of action.[90]

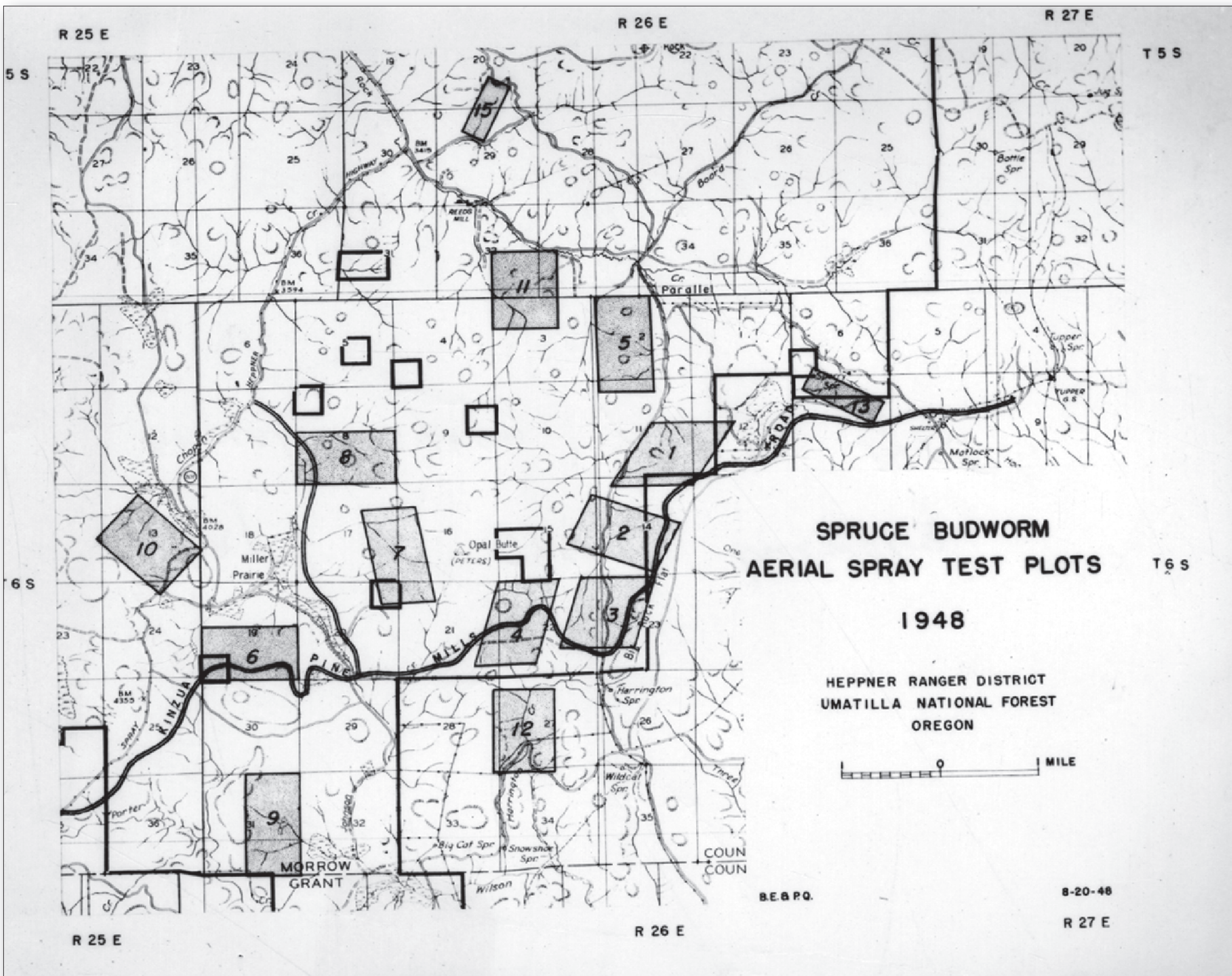


Figure 48. *Map of spruce budworm aerial spray test plots. June 1948. Photo by C.B. Eaton. USFS Portland Station Collection, Eaton-1.*

[90]Larson, R.C. 1977. Western forest entomology history: an oral history interview with Robert L. Furniss. October 14, 1977. Portland, OR. Durham, NC: Forest History Society. p. 11-12.

From *The Spruce Budworm in Oregon and Washington – Season of 1948*:

Introduction:

. . .

The situation at the end of the 1947 season, as reported by Buckhorn, pointed clearly to an impending need for reliable control measures. Since no proven measure was available, the cooperating agencies and the Kinzua Pine Mills Company decided to undertake a large-scale experiment to test the treatments that had given most promise over a period of years in the Eastern United States and Canada. The experiment was conducted in late June and July on the Heppner Ranger District of the Umatilla National Forest. It was demonstrated that aerial application of one pound of DDT in one gallon of fuel oil, when properly timed, gives upward of 95 percent control. Thus a tested and relatively economical control measure became available concurrently with the developing need.

. . .

Survey of 1948

The survey of 1948, as that of 1947, was in two parts, the detection or aerial reconnaissance phase and the ground checking phase. The aerial reconnaissance was done in several types of aircraft and consisted of sketch mapping the infestation in place. Some 43 hours were spent in the air covering 6,898,900 timbered acres in the Blue Mountains. An additional 22 hours were spent in covering 4,465,000 timbered acres extending from the northeastern tip of the Mt. Hood to the northern part of the Umpqua National Forests. The boundaries and intensity of infestation were checked on the ground and an attempt was made through egg counts to evaluate next season's infestation. The ground checking required 47 man-days in the Blue Mountains and 28 man-days in the Cascades.

In 1948 the budworm could be found literally everywhere in the Blue Mountains. Only those stands with defoliation sufficient to detect from the air were recorded. This course was taken because the means were not at hand to delineate the areas of very light infestation. Accordingly, the total acreages given in this report are low.

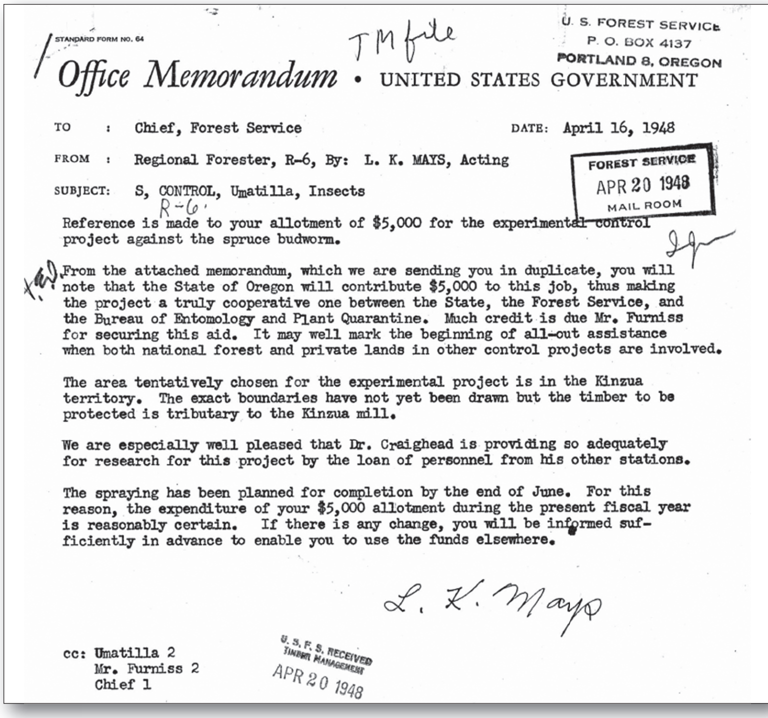
. . .

Recommendations:

The following recommendations are a summary of what has been proposed in more detail in the preceding text. It is proposed:

1. *That control work against the budworm in 1949 be limited to one project up to about 100,000 acres, or at most two large projects;*
2. *That control on the Springfield area in western Oregon be given first priority;*
3. *That control on the eastern slopes of the Mount Hood National Forest be given second priority;*
4. *That conditions in the Blue Mountains be further discussed before a final decision is made for or against control.*
5. *That studies of the budworm in the Pacific Northwest be intensified in order to improve preventive and control methods.*
6. ***That detection surveys along the line developed in 1947 and 1948 be continued in 1949 and that special consideration be given to the optimum timing of the aerial reconnaissance.***[91]

[91]Furniss, R.L.; Buckhorn, W.J.; Wright, K.H. November 1, 1948. The spruce budworm in Oregon and Washington – Season of 1948. Portland, OR: BEPQ. 12 p.



STANDARD FORM NO. 64

TM file

U. S. FOREST SERVICE
P. O. BOX 4137
PORTLAND 8, OREGON

Office Memorandum • UNITED STATES GOVERNMENT

TO : Chief, Forest Service DATE: April 16, 1948

FROM : Regional Forester, R-6, By: L. K. MAYS, Acting

FOREST SERVICE
APR 20 1948
MAIL ROOM

SUBJECT: S, CONTROL, Umatilla, Insects
R-6

Reference is made to your allotment of $5,000 for the experimental control project against the spruce budworm.

From the attached memorandum, which we are sending you in duplicate, you will note that the State of Oregon will contribute $5,000 to this job, thus making the project a truly cooperative one between the State, the Forest Service, and the Bureau of Entomology and Plant Quarantine. Much credit is due Mr. Furniss for securing this aid. It may well mark the beginning of all-out assistance when both national forest and private lands in other control projects are involved.

The area tentatively chosen for the experimental project is in the Kinzua territory. The exact boundaries have not yet been drawn but the timber to be protected is tributary to the Kinzua mill.

We are especially well pleased that Dr. Craighead is providing so adequately for research for this project by the loan of personnel from his other stations.

The spraying has been planned for completion by the end of June. For this reason, the expenditure of your $5,000 allotment during the present fiscal year is reasonably certain. If there is any change, you will be informed sufficiently in advance to enable you to use the funds elsewhere.

L. K. Mays

cc: Umatilla 2
Mr. Furniss 2
Chief 1

U. S. F. S. RECEIVED
TIMBER MANAGEMENT
APR 20 1948

Figure 49. *April 16, 1948 office memo regarding cooperative funding and planning for Kinzua experimental control project. R6 Aerial Survey Program Files.*

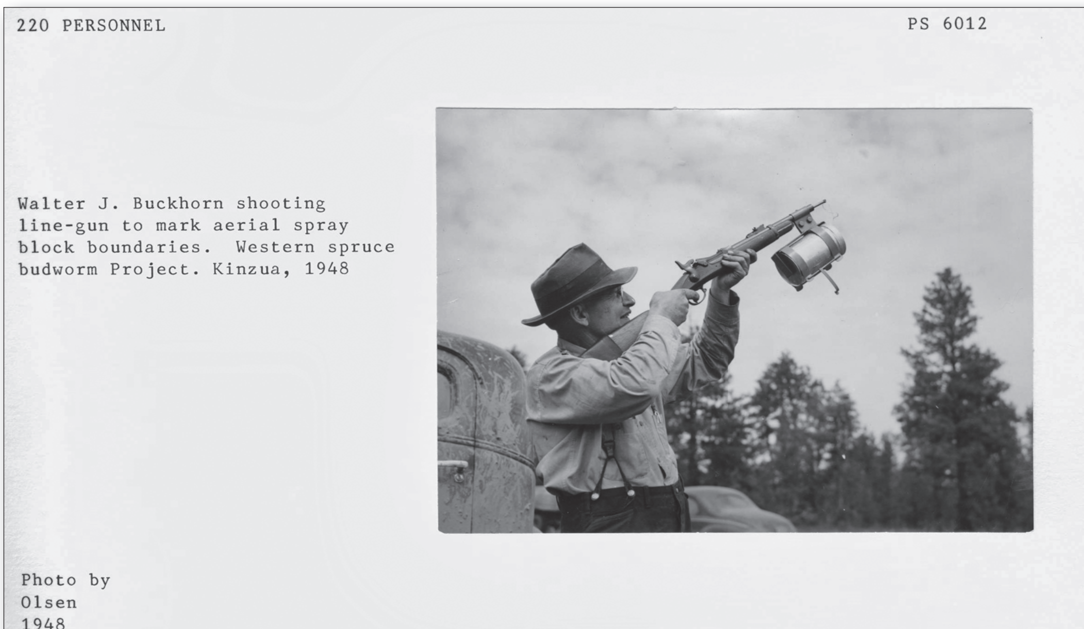


Figure 50. *Walter J. Buckhorn shooting a line-gun to mark aerial spray block boundaries. Western spruce budworm project. Kinzua project 1948. USFS Portland Station Collection, PS-6012.*

Paint Bombs Mark Treetops

W.J. Buckhorn of the Forest Insect Laboratory, Portland, Ore. is shown … demonstrating a line-throwing gun which he developed for use in marking treetops to guide airplane pilots in spraying operations. Using an 1873 model Army Springfield, .45-.70 caliber; a foot long, six ounce brass projectile is fired from the sawed-off barrel over the top of the tree to be marked [Figure 50]. Next the line is used to hoist a paint bomb made from a waxed paper ice cream container filled with paint in which a capped quarter of a stick of dynamite is placed. Electrically detonated, the bomb splatters paint over the treetop in a manner that is readily visible [from the air].[92]

[92]Journal of Forestry. 1949. Forestry news. 47(6):517.

From Eaton, Beal, Furniss, and Speers 1949:

> *In 1948 tests were conducted with DDT applied by airplane and helicopter for control of the spruce budworm (*Archips fumiferana Clem*). This work was done near Heppner, Oregon by the U.S. Bureau of Entomology and Plant Quarantine, in cooperation with the Oregon State Board of Forestry, the U.S. Forest Service, and the Kinzua Pine Mills Company.*
> …
> *Proof was needed of the effectiveness of DDT sprays against heavy populations, with practical spraying procedures that could be used on an actual control operation.*
> …
> *Approximately 4,200 acres of infested forest located in the mixed Douglas-fir and grand fir stands of eastern Oregon, on lands of the Umatilla National Forest and the Kinzua Pine Mills Company, were sprayed under contract with a commercial concern between June 22 and July 2 [Figure 48].*
> …
> *The insecticide was an oil solution of DDT mixed at the rate of 1 pound of technical grade DDT in 1.2 quarts of a hydrocarbon auxiliary solvent diluted to 1 gallon with fuel oil. The spray was mixed in the field with a mobile tank-mixing unit [Figure 55].*
>
> *Both a biplane (Travelaire 4000) [Figures 51 & 56] and a helicopter (Bell 47 B-3) [Figure 52] were used to apply the spray.*[93]

Figure 51. *Travelaire used on the Kinzua budworm project. Pilots Wear and Olson. June 30, 1948. USFS Portland Station Collection, Olson 136-A.*

[93]Eaton, C.B.; Beal, J.A.; Furniss, R.L.; Speers, C.F. 1949. Airplane and helicopter spraying with DDT for spruce budworm control. Journal of Forestry. 47(10):823-24.

Figure 52. *Bell helicopter and Central Aircraft tank truck used on budworm project. Left to right: pilots Vern Montgomery and Tommy Hall, and Al Lindsten of the Oregon State Board of Forestry. June 30, 1948. USFS Portland Station Collection, Olson 136-B.*

Figure 53. *W.J. Buckhorn and C.B. Eaton on Kinzua budworm project. June 30, 1948. USFS Portland Station Collection, Olson 136-C.*

Figure 54. *Left to right: Al Lindsten (OSBF), Pilot Vern Montgomery, and John Woods Jr. (Assistant State Forester, Oregon) on Kinzua project. June 30, 1948. USFS Portland Station Collection, Olson 136-E.*

Figure 55. *Bell helicopter and Central Aircraft tank truck on loading area along Kinzua road. June 30, 1948. USFS Portland Station Collection, Olson 136-X.*

Figure 56. *Central Aircraft's Travelaire 4000 discharging spray over budworm-infested forest on Kinzua budworm project. June 1948. USFS Portland Station Collection, Eaton-4.*

1949:

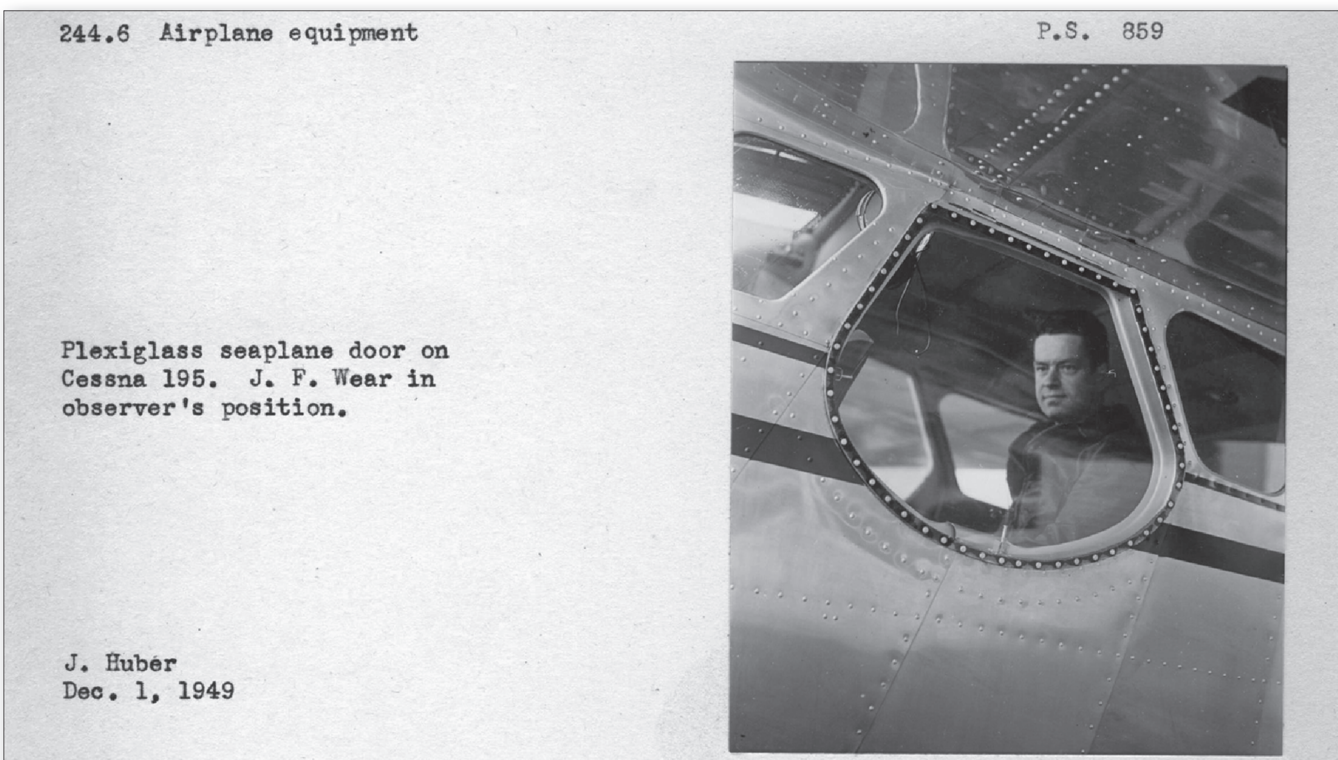


Figure 57. *Cessna 195 with plexiglass door and pilot John Wear. December 1, 1949. Photo by J. Huber. USFS Portland Station Collection, PS-859.*

From Keith Sprengel's *50 Years of Aerial Survey*[94] presentation:

> *1949 was Ken Wright's first year as an aerial observer; he also flew surveys in 1950 and 1952. Training included working with aerial photos, planimetric, and topographic maps, measures of airworthiness, navigation ability, and practice flights to work on estimating areas, tree species and identification of insect damage from the air and as Ken Wright put it: "tons of ground checking".*[95]

The first formally organized Western Forest Insect Work Conference (WFIWC) was held in Portland, OR on Dec. 7 1949 in conjunction with the Western Forestry and Conservation Association (WFCA) meeting:

> *In attendance:*
>
> *J.W. Bongberg, Entomologist, Berkeley, CA*
> *W.J. Buckhorn, Scientific Aid, Portland, OR*
> *William K. Coulter, Entomologist, Portland, OR*
> *James C. Evenden, Entomologist in Charge, Coeur d'Alene, ID*
> *Ralph C. Hall, Entomologist, Berkeley, CA*
> *A.J. Jaenicke, Forester, Portland, OR*
> *F.P. Keen, Entomologist in Charge, Berkeley, CA*
> *Philip C. Johnson, Entomologist, Coeur d'Alene, ID*
> *Alvin Lindsten, Forester, Oregon State Board of Forestry; Bend, OR*
> *L.W. Orr, Entomologist in Charge, Ogden, UT*
> *D.E. Parker, Assistant Division Leader, Beltsville, MD*
> *W.L. Popham, Assistant Chief, Washington DC*
> *Hector A. Richmond, Officer in Charge, Dominion, Victoria, BC Canada*
> *George R. Struble, Entomologist, Berkeley, CA*
> *J.F. Wear, Airplane Pilot, Portland, OR*
> *J.M. Whiteside, Entomologist, Portland, OR*
> *B.H. Wilford, Entomologist, Fort Collins, CO*
> *John D. Woods, Assistant State Forester, Salem, OR*
> *N.D. Wygant, Entomologist in Charge, Fort Collins, CO*
>
> *Mr. Keen and Mr. Jaenicke were asked to serve as temporary chairman and secretary, respectively.*
>
> *. . . a roundtable discussion was held on the spruce budworm (*Choristoneura fumiferana (Clem.)*) problem in the western provinces and states of Canada and the United States respectively. The budworm infestations now present in many Douglas-fir forests have been unusually severe and widespread during the past few years and extensive aerial spraying is planned in 1950 for its control in parts of Oregon, Washington, and Montana.*
>
> *The whole-hearted discussion by those working on some phase of the problem brought out many extremely pertinent facts pertaining to (1) variations in the budworm life history, (2) habits of the overwintering initial instar caterpillars, (3) population density determination, (4) the mode of buildup and spread of outbreaks, (5) budworm survey procedures, (6) applied control methods, and (7) the effects of parasites and wilt disease.*[96]

Since 1949, WFIWC has continued to provide an important annual venue to share western U.S. and Canadian aerial survey information and developments.[97]

[94]In 1996 and 2007, 50 and 60 year aerial survey program celebrations were held in conjunction with annual R6 Forest Health Protection Technical meetings. Keith Sprengel compiled images, conducted interviews, and created presentations for each celebration. Narratives, photos and interview notes from Keith's presentations and preparatory work are used throughout this document.

[95]Sprengel, K.W. 1996. 50 years of aerial survey presentation. Portland, OR. R6 aerial survey program files. Sandy, OR.

[96] WFIWC proceedings. Dec. 7, 1949. Portland, OR. 3 p.

[97]A collection of all WFIWC proceedings are available online at: http://wfiwc.org

From *Forest Insect Surveys Aerial Detection Season 1949*:

> *The year of 1949 marks the first time that all of the forty-nine million acres of coniferous timber types in Oregon and Washington, exclusive of Spokane, Pend Oreille, and Stevens Counties in northeastern Washington, which are under the jurisdiction of Region 1 of the Forest Service and the Forest Insect Station at Coeur D'Alene, Idaho, have been covered by a forest insect survey.*
>
> *This survey was conducted in two phases, namely aerial and ground. The aerial phase of the survey, which this report deals, was carried out as a cooperative project between the Oregon State Board of Forestry, the U.S. Forest Service, and the Bureau of Entomology and Plant Quarantine.*
>
> *The field work was carried on by two crews, the personnel of which were as follows: Crew No. 1 – pilot James Brigham and observer Alvin Lindsten, of the Oregon State Board of Forestry, also observer Kenneth Wright of the Bureau of Entomology; this crew covered timber stands in Oregon west of the Cascade Summit amounting to some fifteen million acres. Crew No. 2 – pilot J.F. Wear and observer, W.J. Buckhorn of the Bureau of Entomology and Plant Quarantine; they were assisted during four days by R.C. Heller of the Washington Office of the Bureau of Entomology; this crew covered the timber stands in Oregon east of the Cascade Summit and the stands in Washington which amounted to some thirty-four million acres.*
>
> *Aircraft for the survey, except for the coastal region of Washington, was contracted for by both the State and Forest Service. The State furnished the ships for Crew No. 1. This crew used a Stinson station wagon for two days at the start of the survey and a Cessna "170" for the remainder of the time. The Forest Service provided crew No. 2 with a two-place Luscombe "Observer". However a larger plane was needed when Heller joined the crew and the Service provided a Cessna "170" for that period. The coastal region of Washington was covered in a Cessna 195 [Figure 57] recently acquired by the Bureau. The Cessnas proved to be excellent ships for this type of work….*
>
> *Survey methods employed by the two crews closely followed the methods developed by Buckhorn and Wear on the aerial surveys in eastern Oregon in 1947 and 1948. All major forest types were intensively covered either by "contouring" or "gridironing". All infestations, both bark beetle and defoliator, were sketch-mapped in place according to degree of intensity. The course of the plane was plotted on the map simultaneous with the progress of flight in order to keep oriented with the ground and to assure complete coverage of all areas.*
>
> *Crew No. 1 began the survey of western Oregon on July 6. Considerable cloudiness and rain prevailed but by shifting operations from one portion of the area to another they were able to circumvent the weather and this portion of the region was completed by August 1.*
>
> *Crew No. 2 began operations in the Blue Mountains region of Oregon on July 12. Eastern portions of Oregon and Washington were completed by August 6, but due to clouds, rain and smoke, western Washington was not completed until October 19.*
>
> *Although the survey period in western Washington was more prolonged than desirable for spotting defoliations, it is felt that no significant infestations were missed.*
>
> *After the aerial reconnaissance was completed, or while waiting out periods of bad weather, ground examinations were made on the more critical centers of infestation spotted from the air. Wright and Lindsten carried out the ground checking in western Oregon. Buckhorn and Wear checked most of the areas spotted in eastern Oregon. Mr. J.M. Whiteside of the Bureau visited a number of infestation centers in eastern Washington, and Mr. W.K. Coulter, also of the Bureau, ground-checked most of the centers spotted in western Washington.[98]*

[98] Lindsten, A.; Buckhorn, W.J. 1949. Forest insect surveys aerial detection season of 1949. OSBF; BEPQ. p. 1-3.

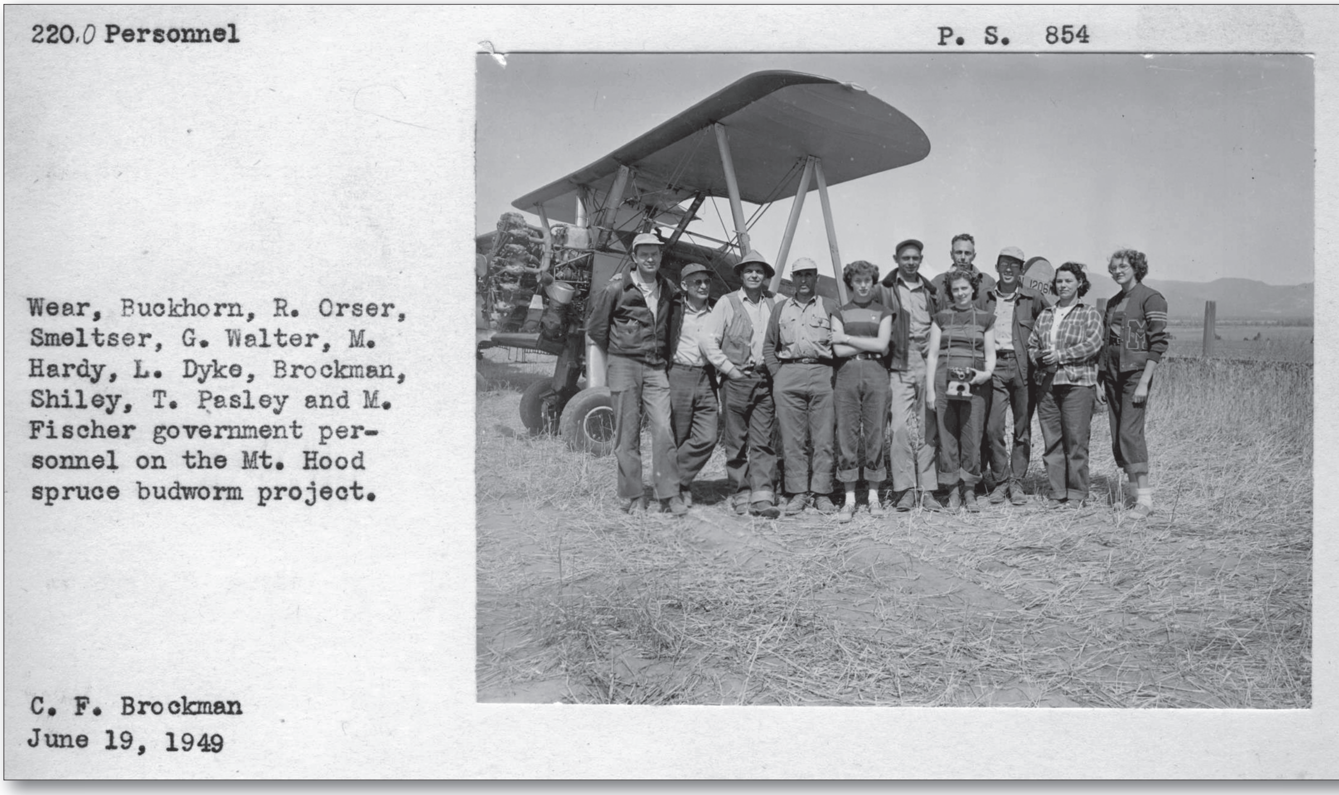


Figure 58. *Government personnel on the Mt. Hood spruce budworm project. Left to right: John Wear, Walter J. Buckhorn, R. Orser, Smeltser, G. Walter, M. Hardy, L. Dyke, C.F. Brockman, Shiley, T. Pasley, and M. Fischer. June 19, 1949. Photo by C.F. Brockman. USFS Portland Station Collection, PS-854.*

From the November Journal of Forestry, *Forestry News*:

> **Budworm Campaign Planned:**
>
> *Plans for next year's spruce budworm control battle in Oregon are being worked out by a sub-committee appointed at a meeting of lumbermen and state and federal forestry officials held in Portland on September 8. The sub-committee consists of John B. Woods, Jr. and Richard Berry of the Oregon state forestry office; R.L. Furniss, U.S. Bureau of Entomology [and Plant Quarantine]; E.L. Kolbe, Western Pine Association; William Hagenstein, West Coast Lumberman's Association; Stuart Moir, Western Forestry and Conservation Association; Paul Saunders, Willamette Valley Tree Farms; L.T. Webster, Washington state forestry office; Lou Alexander, Bureau of Land Management; Floyd Phillips, U.S. Indian Service; and A.J. Jaenicke, U.S. Forest Service.*
>
> *Over 200,000 acres of timberland were sprayed with DDT this year, with a 97 percent bug kill. The sub-committee hopes to develop plans for spraying the remaining 2,232,250 acres in Oregon and Washington.*[99]

1950:

In 1950 the new **national** BEPQ forest insect survey program was headquartered at the Agricultural Research Center in Beltsville, Maryland, Dr. Harvey J. MacAloney in charge:

> *Dr. Harvey J. MacAloney has been selected to have immediate supervision over the forest insect survey, BEPQ. This is a new activity on the part of the Bureau, and is provided for under the Forest Pest Control Act, approved by Congress in 1947.*

[99]Journal of Forestry. 1949. Forestry news. 47(11):947

The survey is carried on from headquarters at the Agricultural Research Center, Beltsville, MD and at eight field stations located in important forest regions: Fort Collins, CO; Berkeley, CA; Coeur d'Alene, ID; Portland, OR; Ogden, UT; Milwaukie, WI; New Haven, CN; and Asheville, NC. It involves close cooperation between the Bureau and other federal and state agencies as well as with private timberland owners in coordinating the work of the various agencies in their efforts to detect potentially dangerous infestations of forest insects in the early stages.[100]

From the *Report of Forest Insect Detection Surveys in Oregon and Washington Season of 195*0:

Introduction:

The current widespread epidemic of the spruce budworm continues as a major threat to the forests of Oregon and Washington. Control efforts during these past two years have unquestionably prevented extensive timber killing, but vast areas of infestation remain, and the continuation of a vigorous control program is still urgently needed.

Surveys made during the years 1947 to 1949 showed the budworm outbreak to be developing rapidly, both in size and intensity. The 1949 survey, a joint undertaking by the federal government, the States of Oregon and Washington, and the timber owners, was the first all-inclusive forest insect survey of these two states. This survey, conducted by aerial and ground methods, showed epidemic infestation on 2,276,000 acres.

The first effort to control the outbreak was a program conducted during May and June of 1949 by the U.S. Forest Service and the Oregon State Board of Forestry. This program included the treatment of 106,000 acres on the Mt. Hood National Forest and 161,000 acres in the vicinity of Eugene, Oregon. While satisfactory control was obtained in the areas treated, the results of the 1949 survey pointed to the need for a greatly expanded and accelerated control program.

Accordingly, during late June and July 1950, 933,700 acres were treated. Areas of heavy infestation in all epidemic centers were included in this program, and control results were uniformly excellent.

During the summer of 1950, another comprehensive survey was conducted. The survey techniques used in 1949 were employed, and once again, public and private agencies and individuals generously participated.

Acknowledgements:

This report is the product of much cooperative effort. The Bureau of Entomology and Plant Quarantine and the Oregon State Board of Forestry took the lead in coordinating the survey program and reporting the results. Mr. John M. Whiteside headed the program for the Bureau, and Mr. Alvin Lindsten acted in the same capacity for the State of Oregon. Mr. William D. Hagenstein, forest engineer of the Forest Conservation Committee of the Pacific Northwest Forest Industries, and Mr. E.L. Kolbe, chief forester of the Western Pine Association, were very helpful in enlisting wide participation by individual foresters. The many individuals and organizations that took part in the detailed ground sampling for the spruce budworm are listed in tables 7-11.

The aerial phase of the survey was a two-way undertaking by the Bureau of Entomology and Plant Quarantine and the Oregon State Board of Forestry. The State surveyed all of Oregon except the Blue Mountains. The Bureau surveyed the Blue Mountains and all of Washington. For the State, Mr. A. Larson was pilot, and Messrs. A. Gruba and A. Lindsten were observers and mappers. For the Bureau, Mr. J.F. Wear was the pilot and Messrs. W.J. Buckhorn, A.T. Davison, W.K. Coulter, and K.H. Wright were observers and mappers.

The ground checking of the aerial survey was done primarily by Messrs. J.M. Whiteside, W.J. Buckhorn, A.T. Davison, J.F. Wear, W.K. Coulter, and K.H. Wright for the Bureau, and A. Lindsten and A. Gruba for the State.

Aircraft used in 1950 aerial surveys: Cessna 195 (9367A) and Stinson Station Wagon (6077M) [Figure 59].

[100]Journal of Forestry. 1950. Forestry news. 48(10):747.

Figure 59. *Stinson Station Wagon used in the 1950 aerial survey. USFS, R6 Aerial Survey Program Collection.*

Cooperators in Budworm Ground Surveys in Western Oregon and Western Washington - 1950

Public agencies:

Oregon State Board of Forestry
U.S. Bureau of Entomology and Plant Quarantine
U. S. Bureau of Land Management
U. S. Forest Service
U. S. Indian Service
Washington Division of Forestry

Private Companies:

Alcoa Mining Company
Booth-Kelly Lumber Company
Coos Bay Lumber Company
Crown Zellerbach Corporation
Fischer Lumber Company
Gardiner Lumber Company
Irwin-Lyons Lumber Company
L.H.L. Lumber Company
Long-Bell Lumber Company
Longview Fiber Company
Mason, Bruce, and Girard
Pope and Talbott Incorporated
Peshastin Lumber Company
Rayonier Incorporated
South Olympic Tree Farm

St. Helens Pulp and Paper Company
Tree Farm Management Service
Weyerhaeuser Timber Company
Willamette Valley Lumber Company[101]

Aerial survey-related notes from the 1950 WFIWC proceedings:

Page 17:
Whiteside: *Surveys in Oregon and Washington have been made annually since 1947 to detect and appraise current outbreaks of the spruce budworm. Prior to 1949 they were conducted by the forest insect laboratory at Portland (Oregon). Beginning in 1949 the surveys have been a joint undertaking between the laboratory, the U.S. Forest Service, the states of Oregon and Washington, and the larger timber owners. The surveys combine aerial observation and ground checking. The more visible centers of heavy budworm defoliation are located from the air. Ground checking is employed to (1) record the extent of the infestations, (2) check year-to-year changes in infestation intensity, and (3) provide a guide for aerial observation.*

Page 24:
Wygant: *Most surveys in the region are pre-control in nature. Present surveys stress the damage caused by a given insect as a basis for control. There is a need for more insect population data from the surveys.*

Parker: *The Division of Forest Insect Investigations of the BEPQ has recently appointed a Division leader in charge of forest insect surveys. The Division's survey programme is now operating in 8 of the 9 Forest Service regions of the U.S. An expanded programme of surveys is needed in most regions to cope with the pressing insect problems. The fact that control needs influence the surveys of the U.S. is evidenced by the fact that the survey effort is aimed at obtaining information of emergency outbreaks.*

Richmond: *Canadian and U.S. surveys are similar since in the final analysis both are directed at the control of injurious forest insects.*

Jaenicke: *It is a fact that in the US the Forest Pest Control Act definitely ties the survey to control. Surveys perhaps should be financed on the merits of the surveys themselves.*

Parker: *It may take a few years for surveys to be planned as a distinct function apart from control needs, but this may come eventually.*

Page 28:
John M. Whiteside: *Current forest insect research in Oregon and Washington:*
#7 – Improvement in aerial survey methods in the ponderosa pine region.[102]

[101] OSBF; BEPQ. 1950. Report of forest insect detection surveys in Oregon and Washington Season of 1950. 34 p.

[102] WFIWC proceedings. 1950. Fort Collins, CO. December 15-16, 1950.

1951:

The first ODF survey aircraft was purchased:

> *Oregon State Department of Forestry purchased a Cessna 170 aircraft for aerial surveys, aerial supervision on spruce budworm control projects, fire control, aerial photography, aerial inspection and transportation.*[103]

From the *Report of Forest Insect Detection Surveys in Oregon and Washington Season of 1951*:

> *A fifth comprehensive and fully cooperative forest insect detection survey, covering some 49,000,000 acres of forested lands in Oregon and Washington, exclusive of the three northeastern counties in Washington, was begun on June 19, 1951 while the spruce budworm control project of 1951 was still in progress. Aerial and ground survey techniques, similar to those employed in 1949 and 1950 were followed and, once again, public and private agencies and individuals generously participated in the program.*
>
> *In general, the 1951 budworm survey was hampered by the serious forest fire situation in both states which prevented many individuals associated with the ground survey in former years from participating in the program and which also slowed the progress of the aerial phase of the program. In spite of this handicap, the following accomplishments can be reported for 1951: 1) the aerial survey was completed in 202.3 hours of flying time; 2) some 399 man days were expended by the 123 individuals participating in the budworm ground survey; and 3) in lightly infested areas 3,474 sample plots were examined for the presence or absence of the budworm, with this insect being found on only 161 (4.6 percent) of the plots.*
>
> **Acknowledgements:**
>
> *The Bureau of Entomology and Plant Quarantine and the Oregon State Board of Forestry assumed the lead in conducting and coordinating the survey program and reporting the results.*
>
> *The aerial phase of the 1951 survey was a cooperative undertaking between the Oregon State Board of Forestry, the Bureau of Entomology, and the U.S. Forest Service. The State surveyed all of western Oregon. The Bureau surveyed all of eastern Oregon and all of Washington. After the unfortunate accident, which wrecked the Bureau's Cessna 195, the Forest Service financed the rental of a Cessna 170 to complete the Bureau's portion of the aerial survey. For the State, Mr. A. Larson was pilot and Messrs. A. Lindsten, R. Stevens, and W. Slater were observers and mappers. For the Bureau, Mr. J. F. Wear was pilot and Messrs. W.J. Buckhorn, H.L. Haglund and W.K. Coulter were observers and mappers.*[104]

This "unfortunate accident" that wrecked the Bureau's Cessna 195 is referenced in a letter from John Wear to M.M. Furniss:

> *… [1949] we upgraded to a Cessna 195 for visual surveys, aerial photography, and visual strip viewing through the camera hatch in the back. An adjustable strip viewer was developed for bark beetle damage assessment at various altitudes and strip widths … a U.S. Navy surplus K-17 12" camera was mounted in the 195 for photo surveys as high as 12,000 ft. above sea level. Lateral and forward visibility was not good from the 195 and it had bad ground looping characteristics. … a bad cross wind dinged a wing …*[105]

…and further explained to Keith Sprengel by John Wear on February 13, 2007; from Keith's notes:

> *The accident happened in Bellingham, Washington. The airport had a tower, but offered no specific information as to conditions when queried about weather conditions. Furthermore, the "wind T" showed no movement. As it turned out, there were 38-40 knot crosswinds. John was unprepared for the conditions and the aircraft ended up doing a "ground loop", broke a landing strut and landed on its side. The Cessna did not have "cross wind gear", which John explained as a*

[103]ODF. 2014. A chronology of Oregon's forest insect and disease program with highlights of historical events and emphasis on the Oregon Department of Forestry. Unpublished report compiled by: LeRoy N. Kline; Eugene A. Irwin; Dave Overhulser; et al. Hardcopy, R6 aerial survey program files. Sandy, OR.

[104]OSBF; BEPQ. 1951. Report of forest insect detection surveys in Oregon and Washington Season of 1951. 35 p.

[105]Letter courtesy of M.M. Furniss and the Western Forest Insect Work Conference archives.

rear wheel that swiveled. The airport had also left the "wind T" locked down. The damage was reported to be about $3,000, but the Station elected to total the aircraft rather than repair it. Since they didn't do "that kind of thing" in 1951, there was no formal report, certainly not with the NTSB.[106]

Aerial survey-related discussions from the 1951 WFIWC proceedings:

Current forest insect research:
Page 3:
Furniss:
(6) Forest insect aerial survey technique improvements, particularly refi nements in aerial sketch mapping of defoliator outbreaks, aerial strip viewing, and the application of aerial photographs in dense Douglas-fi r and hemlock stands and in more open ponderosa pine stands.

Page 15:
Furniss: *Spruce budworm was found in every Douglas-fir or* Abies *stand in Oregon and Washington during 1951 except those in the Olympic Peninsula. No new dead trees were found in the 1951 survey.*

Discussion regarding diseases in the aerial survey:
Pages 27-28:
Buckhorn*: On recent forest insect aerial surveys efforts have been made to map fungus diseased areas such as white pine blister rust, larch blight, fir needle cast, and pine needle cast. The causal agent in each case has been determined from subsequent ground checks.*

Furniss: *Many areas of fungus infection are relatively easy to detect. There are many opportunities to incorporate pathologists on our insect surveys, but too many non-entomological objectives seriously interfere with the insect survey objectives.*

Page 29:
Whiteside: *Without the help of the Forest Service, principally through Mr. Jaenicke, the plot survey system could not have been maintained in recent years. Men who in the past were part of the plot survey crews are now among the best insect survey cooperators in the region.*

Beal: *Surveys were a distinct Bureau function until the adoption of the pest act. Some criticism has come from the outside that pest act survey funds were being used for research. Education is needed to show the positive tie between research and surveys [see Beal 1952].*

Presentation by Buckhorn and Wear (plus discussion) on R6 aerial survey methods:
Pages 33-37:

- Early aerial surveys include those for hemlock looper in western Oregon (Keen and Beal, 1931) (Furniss 1945) and in Alaska (Furniss 1946).

- In 1949 the Oregon aerial survey program aimed to map all insect outbreaks. In 1951, the aerial survey utilized 220 hours of flying time in OR and WA. Several observer and aircraft combinations have been studied. The best – helicopters. A Cessna 170 plane is operated by the Portland laboratory for aerial survey work. Two observers are best. Flight lines 6 miles apart on grid and contour systems are used.

- Preparations to fly include assembling of forest type and cultural maps, preferably to a scale of ¼ inch to the mile. Maps sufficient for a full day's flying. U.S. Forest Service maps excellent for detail. Maps used on sheet of Masonite 15x17 inches. Predetermined flight lines may be marked on map, but these are not essential. Map orientation is maintained by tracking plane's progress on map at all times, a "must" over unfamiliar areas. Top of map is kept northward while tracking. Tracking also valuable for subsequent plotting of flight location and to indicate where unflown areas exist. In mapping large infestations from the air use as many topographic and cultural features as possible; either those on the ground or on observer's map. Dot or circle small infestations.

[106] Hardcopy notes, R6 aerial survey program files. Sandy, OR.

- Timing of aerial surveys is dependent upon most visible states of infestations to be examined and upon optimum flying and air visibility conditions. Observer must be able to identify infested tree species, and, if possible, the insect responsible for the infestation. Symptoms of non-insect tree damage should also be noted (fungus, porcupines, winter drying, cone crops, flooding, burns, snowbreak, genetic off-color of tree foliage, bears.)

- Average flying altitude for defoliators, 500-800 feet above tree tops; for bark beetles, 1,500 feet. Air speed about 100-110 mph (cruising speed of Cessna 170). Ground check follows aerial surveys where the areas are accessible.

- Wear lead an extensive discussion about photos as not feasible for regional surveys.[107]

Work plan for the 1951 mountain pine beetle survey on the Wanoga Butte area, Deschutes NF:

The aerial survey over this area, completed by W.J. Buckhorn, H.L. Haglund, and J.F. Wear of the Portland Forest Insect Laboratory mapped out the exterior boundaries of the epidemic as revealed by the red-topped trees representing the 1950 attack.[108]

June 11, 1951 memo from R.L. Furniss to the Regional Forester:

On May 16, 1951, fifteen of the recorded centers were checked from the air by R.L. Furniss, J.F. Wear, and D.C. Prentice-forest-engineer for the Western Pine Association.[109]

1952:

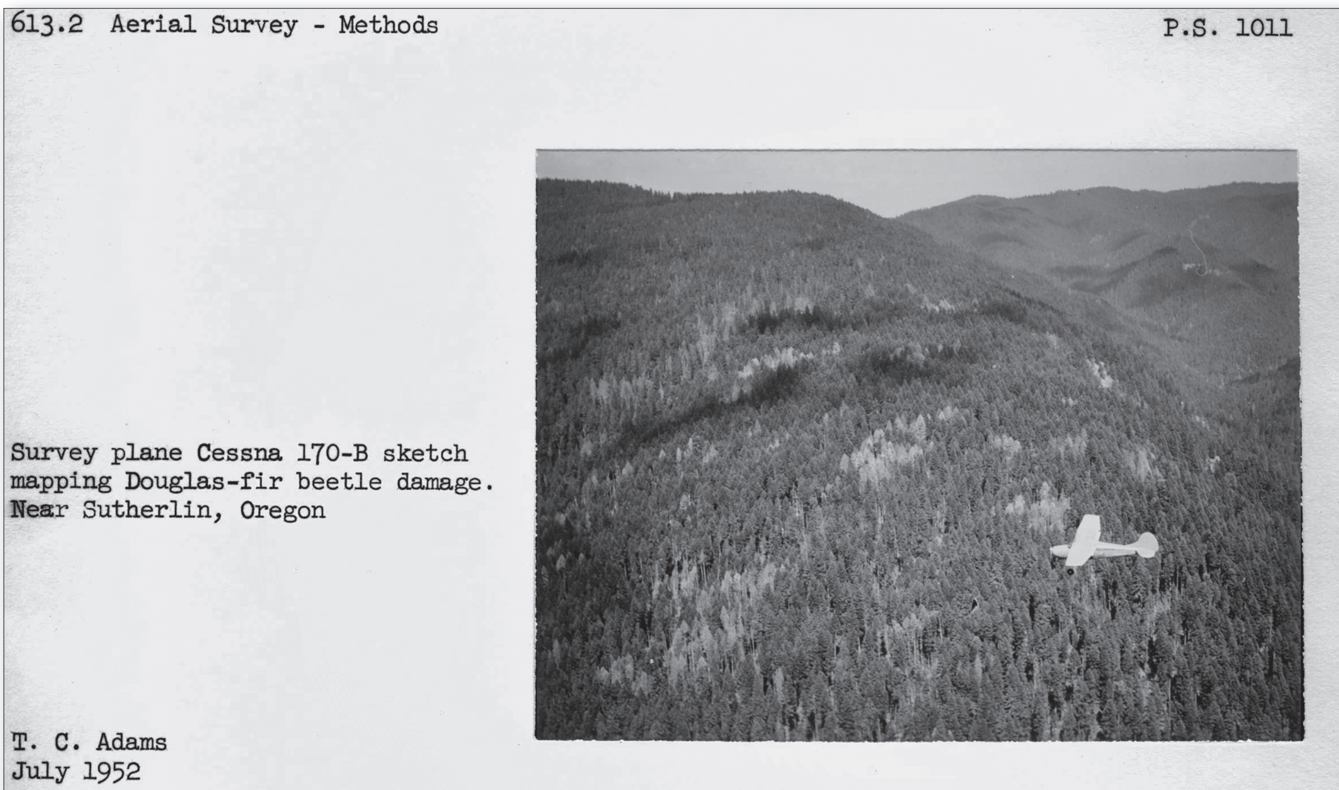


Figure 60. *Survey plane Cessna 170-B sketch mapping Douglas-fir beetle damage. Near Sutherlin, Oregon. July 1952. Photo by T.C. Adams. USFS Portland Station Collection, PS-1011.*

[107] WFIWC Proceedings. November 26-28, 1951. Portland, OR.

[108] Hardcopy, R6 aerial survey program files. Sandy, OR.

[109] Ibid.

From Sprengel's *50 Years of Aerial Survey:*

Peter Orr came along in 1952 as a seasonal employee working on the Bear Springs RD. Buckhorn and Wear asked Pete if he would like to come along on a flight….he didn't get sick, so, in his own words he was "dragooned" into aerial survey…he was flying as a fully qualified observer by 1954 and continued to do so until 1972 when he was transferred to the NE area. Being a dedicated entomologist, Peter couldn't resist calling Tommy Gregg on his way out of the state to inform him of a developing DFTM outbreak. Peter retired as the staff director for the NE area in 1990.[110]

From *Role of the States and Private Timber Owners in Cooperative Forest Pest Control* (Beal 1952):

The U.S. Bureau of Entomology and Plant Quarantine maintains a small staff of specialists trained in survey and control methods at its field locations located in each of the broad forest regions of the United States and Alaska. It is the responsibility of these men to conduct surveys and to train forest personnel, representing private, state and federal agencies, to recognize and report incipient outbreaks of dangerous insects. Furthermore it is their job to coordinate the detection survey reports; to examine in detail all forest areas where these surveys indicate serious threats from insect pests; to make appraisal surveys of such areas where needed, as a basis for control recommendations; and to give technical guidance and assistance on all control projects.

…

As a final word it may be said that remarkable progress has been made in the detection and control of widespread forest-insect outbreaks under the provisions of the Pest Act. The success of cooperative efforts to control spruce budworm outbreaks in the Pacific Northwest is indication enough that the philosophy of cooperative endeavor as envisaged by the act is sound.[111]

From the *Report of Forest Insect Surveys in Oregon and Washington Season of 1952*:

Introduction:

In the opinion of experienced observers, 1952 has been the worst "forest insect" year on record in Oregon and Washington. The results of the cooperative forest insect surveys of 1952, herein reported, support this opinion. Of the 49,000,000 acres of forest land in the two states, a total of 7,411,680 acres harbor outbreaks of forest insects. A combination of defoliators, bark beetles, windstorms and drought have brought about the present situation. From the evidence at hand, 1953 may see even greater insect-caused losses. Thus, the owners, managers, and users of the forest resources are faced with unprecedented salvage and control problems.

Three separate cooperative surveys were necessary in 1952 to obtain data on forest insect epidemics. During the period from February to April an aerial survey of the Douglas-fir stands in western Oregon and southern Washington was conducted to obtain preliminary information on the extent and seriousness of a Douglas-fir beetle epidemic that developed in 1951 from a buildup in windthrown timber. A second and more intensive aerial survey of this situation, supplemented by ground sampling, was made during the summer to obtain detailed data on the location and amount of beetle-killed and windthrown timber as a basis for developing salvage-control operations. The third or regional survey, to collect data on the spruce budworm and all other major forest insects in the two states, had to be postponed nearly a month later than usual because of the priority of the special survey in the Douglas-fir region and because of the spruce budworm control project. The regional survey had to be called off on September 22 because of dense layers of smoke and resulting poor visibility, leaving a large acreage of timberland in Western Oregon and Washington un-surveyed. It is planned to complete this survey when the fall rains have cleared the air.

Acknowledgements:

In 1952, three distinct forest insect detection surveys were conducted in Oregon and Washington through the cooperative effort of many individuals and organizations.

[110]Sprengel, K.W. 1996. 50 years of aerial survey presentation. Portland, OR. R6 aerial survey program files. Sandy, OR.

[111]Beal, J.A. 1952. Role of state and private timber owners in cooperative forest pest control. Journal of Forestry. 50(11):859-861.

A. *The Douglas-fir reconnaissance survey which was completed in April, was a cooperative undertaking between the Weyerhaeuser Timber Company, Oregon State Board of Forestry, and Bureau of Entomology and Plant Quarantine. Two aerial survey crews were formed. One crew, consisting of Messrs. J.F. Wear, pilot and W.J. Buckhorn, observer for the Bureau, and P. Lauterbach [see Figure 62], observer for the Weyerhaeuser Timber Company, surveyed in a Cessna 170 rented by the timber company. The second crew, composed of Messrs. A. Larson, pilot, and R. Stevens, observer for the State and K.W. Wright, observer for the Bureau surveyed in a Cessna 170 owned by the State of Oregon.*

B. *The Douglas-fir beetle blowdown survey, completed in September, was a cooperative undertaking by the U.S. Forest Service, Bureau of Land Management, Bureau of Entomology and Plant Quarantine, Oregon State Board of Forestry, and private timber companies. The roster of personnel cooperating on this project will be recorded in a report covering the findings of the survey. [See Aerial Mapping crews from Operations Manual Blowdown Bark Beetle Survey 1952.]*

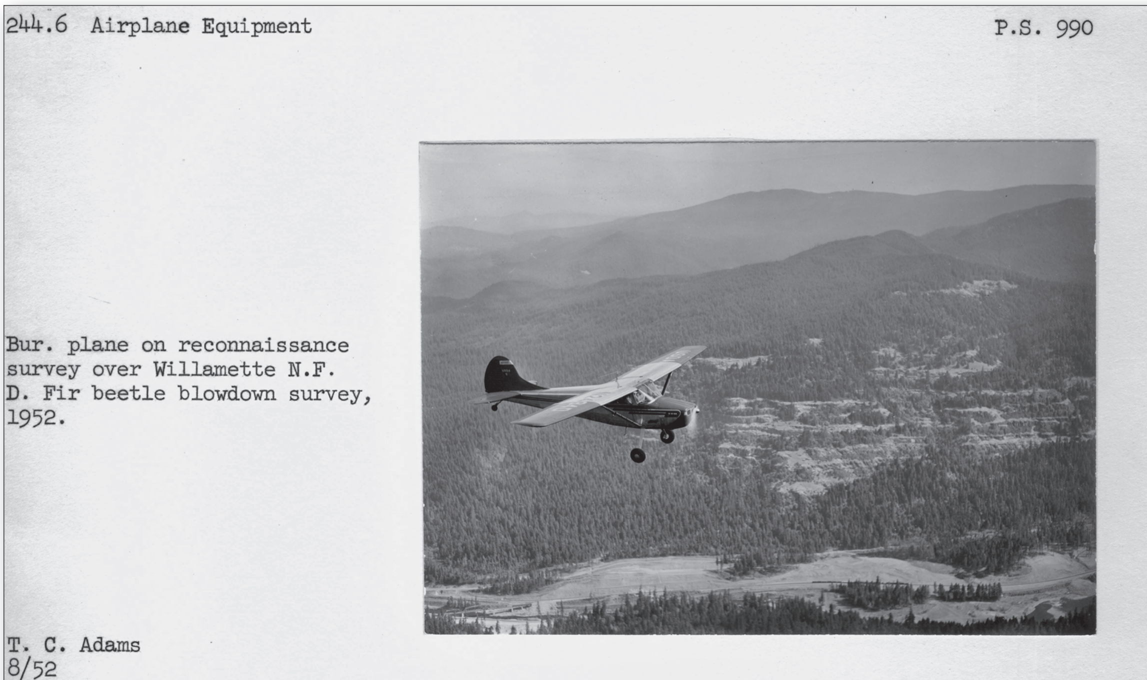


Figure 61. *Bureau of Entomology and Plant Quarantine plane on reconnaissance survey over Willamette National Forest. Douglas-fir/blowdown survey. August 1952. Photo by T.C. Adams. USFS Portland Station Collection, PS-990.*

Figure 63. *Blowdown/bark beetle survey plane. USFS R6 Aerial Survey Program Collection.*

C. *The aerial phase of the 1952 forest insect detection survey was a cooperative undertaking between the Oregon State Board of Forestry and the Bureau of Entomology and Plant Quarantine. Oregon was surveyed with the State's Cessna 170, with a crew consisting of Mr. A. Larson, pilot and Mr. A. Lindsten, observer and mapper for the State and Mr. W.J. Buckhorn, observer and mapper for the Bureau. Washington was surveyed with the Bureau's Cessna 170B with a crew consisting for Mr. J.F. Wear, pilot and Mr. W.J. Buckhorn, observer and mapper for the Bureau. Mr. W.K. Coulter, of the Bureau, acted as a second observer for part of the survey in northwestern Washington.*

The ground checking of the aerial survey findings was done by Messrs. A. Gruba, A. Lindsten, and D. Sheridan for the State and W.J. Buckhorn, W.K. Coulter, and A.T. Davison for the Bureau.[112]

Figure 64. *1952 Blowdown/bark beetle survey planes, pilots and surveyors. USFS R6 Aerial Survey Program Collection.*

Figure 65. *Most of the project's aerial personnel and overhead from the 1952 Blowdown and Bark Beetle Survey. Photo caption and personnel list is from the back of the photo (above). Additional information [added] from the final report (see Figure 69): Back row: Dick Wilson, USFS, Portland (Leader) [Project Leader to 7/24/1952]; Bob Stevens, BEPQ Berkeley, Cal.; Tom McIntyre, BEPQ New Haven, Conn; Joe Harrell, USFS Portland [contract pilot]; Walt Johnson, USFS Portland [Mt. Hood N.F]; Harry Hawks, USFS [Gifford] Pinchot NF; Unidentified; Morrie Barber, USFS Hebo, OR [Siuslaw NF]; Roy Lamoureaux, BEPQ Oklahoma City, OK [pilot]; Clyde Davis, USFS Colorado [contract pilot]; Ben Spada, USFS Portland [PNFRES]; Dave Olin, USFS G. Pass [Siskiyou NF][Air Operations Officer]; John Wear, BEPQ Portland [pilot]; Hazel Norton, USFS Eugene; Ken Wright, BEPQ Portland [Technical Advisor; Project Leader 7/25-8/20/1952]. Front row: John Lanz, BLM Bend [Portland]; Dave Robinson, USFS Portland [Fremont NF]; Peter Orr, BEPQ Portland; Shorty – USFS Eugene [An E. Hudgins – USFS is listed as a pilot in the final report; this is probably Shorty*[113]*]; Bob Pope, USFS Portland [Field Supervisor]; Unidentified; George Travers, BLM Eugene. USFS R6 Aerial Survey Program Collection.*

[112]OSBF; BEPQ. 1952. Report of forest insect detection surveys in Oregon and Washington season of 1952. 36 p.

[113]Shorty's last name was not recorded in the reference material. Peter Orr believes it was either Hudgins or Huggens. Personal communication with Peter Orr, April 30, 2016.

Figure 66. *A mapping crew preparing to survey, donning their parachutes. Left - Peter Orr. USFS R6 Aerial Survey Program Collection.*

Figure 67. *(left to right) J.W. Merrick (observer), W.G. Hubbard (observer), C.S. Davis (pilot), M.F. Barber (observer). Flight "Baker". 1952 Blowdown and Bark Beetle survey. Photo courtesy of Peter Orr.*

Figure 68. *Flight crew: (left to right) Dave Robinson, Bob Stevens, John Lanz, and [unidentified]. USFS R6 Aerial Survey Program Collection.*

Chestpack type parachutes were worn on all flights and provided an added measure of safety particularly when ferrying to and from the survey areas. When actually flying the flight lines at 800 to 1,000 feet above the terrain the parachutes were worn but in most cases this elevation would not have been sufficient to allow jumps in case of emergency [Figures 66, 67, 68].[114]

[114]Greeley, A.W.; Wright, K.H.; Pope, R.B. 1953. Final report on the 1952 blowdown bark beetle survey in the Douglas-fir region of Oregon and Washington. USFS, PNFRES and BEPQ, Portland Forest Insect Laboratory. p. A-24.

From the *Final Report on the 1952 Blowdown and Bark Beetle Survey in the Douglas-fir Region of Oregon and Washington:*

Roster

Position	Name	Agency
AIR OPERATIONS – HEADQUARTERS, EUGENE, OREGON		
Project Leader to 7/24/52	R. C. Wilson	U.S.F.S. PNW F&R Exp. Sta.
Technical Advisor	K. H. Wright	U.S.B.E.&P.Q. Portland Lab.
Project Leader after 7/25 to 8/20/52		
Air Operations Officer	D. D. Olin	U.S.F.S. Siskiyou N.F.
Chief Pilot	J. F. Wear	U.S.B.E.&P.Q. Portland Lab.
Chief Observer	G. C. Francis	U.S.B.L.M. Eugene District
Field Technician	T. C. Adams	U.S.F.S. PNW F&R Exp. Sta.
Special Weather Forecaster	H. Foltz	U.S. Weather Bureau
Pilots	C. S. Davis	U.S.F.S.*
	J. Harrell	U.S.F.S.*
	E. Hudgins	U.S.F.S.*
	R. M. Lamoureaux	U.S.B.E.&P.Q. Oklahoma City, Okla.
Aerial Observers	M. F. Barber	U.S.F.S. Siuslaw N.F.
	H. J. Hawks	U.S.F.S. Gifford Pinchot N.F.
	W. G. Hubbard	Tree Farm Management Service, Eugene, Oregon.
	W. R. Johnson	U.S.F.S. Mt. Hood N.F.
	J. F. Lanz	U.S.B.L.M. Portland, Ore.
	T. McIntyre	U.S.B.E.&P.Q. New Haven, Conn.
	J. W. Merrick	U.S.F.S.*
	P. W. Orr	U.S.B.E.&P.Q. Portland Lab.
	D. B. Robinson	U.S.F.S. Fremont N.F.
	B. Spada	U.S.F.S. PNW F&R Exp. Sta.
	R. E. Stevens	U.S.B.E.&P.Q. Berkeley, Cal.
	J. A. White	U.S.F.S. Willamette N.F.
Clerk	Hazel Northrup	U.S.F.S.*
FIELD INVENTORY – HEADQUARTERS, EUGENE, OREGON		
Field Supervisor	R. B. Pope	U.S.F.S. PNW F&R Exp. Sta.
Cruisers	B. E. Egger	U.S.F.S. Ochoco N.F.
	R. S. Healy	U.S.B.L.M. Roseburg Dist.
	J. G. Krystad	U.S.B.E.&P.Q. Portland Lab.
	W. F. Schaefer	Ore. State Board of Forestry, Salem, Ore.
	M. Y. Thomason	U.S.F.S. PNW F&R Exp. Sta.

*Employed for this project only.

A-15

Position	Name	Agency
Compassmen	D. S. Haskin	Ore. State Board of Forestry, Salem, Ore.
	J. P. Kososki	U.S.B.E.&P.Q.
	M. Lash	U.S.F.S.*
	J. H. Robinson	U.S.B.L.M. Eugene Dist.
	F. W. Sisson	Ore. State Board of Forestry, Salem, Ore.
FLIGHT MAP PREPARATION – PORTLAND, OREGON		
Supervisor	V. H. Flach	U.S.F.S. Region 6.
Planners	L. A. Carlile	U.S.F.S. Region 6.
	C. W. Gowan	U.S.F.S. Region 6.
	C. Williams	U.S.B.L.M. Region 1.
MORTALITY VOLUME COMPILATIONS – PORTLAND, OREGON		
Supervisor	R. B. Pope	U.S.F.S. PNW F&R Exp. Sta.
Computers	T. C. Adams	U.S.F.S. PNW F&R Exp. Sta.
	J. M. Myers	U.S.F.S. PNW F&R Exp. Sta.
	E. C. Skinner	U.S.F.S. PNW F&R Exp. Sta.
	M. P. Twerdal	U.S.F.S. PNW F&R Exp. Sta.
DRAFTING TO PREPARE FINISHED MAPS – EUGENE AND PORTLAND		
Supervisor	T. C. Adams	U.S.F.S. PNW F&R Exp. Sta.
Draftsmen	K. Flaherty	U.S.F.S. PNW F&R Exp. Sta.
	H. Haglund	U.S.F.S. PNW F&R Exp. Sta.
	R. W. Inman	Ore. State Board of Forestry, Salem, Ore.

Figure 69. *Personnel list from the Blowdown/bark beetle survey.*

Observer Training

A total of 15 observers was trained for the survey, with each one given a period of preliminary ground orientation followed by 12 hours of instruction in the air. The training program was developed and supervised by the technical advisor, the chief pilot and the chief observer. It covered the various phases as outlined below.

Orientation (6 hours).

A. Ground (no time limit)

1. Discussion of purpose of the project.

2. Study of aerial photographs of windthrow and beetle damage

3. Familiarization with 1"-to-the-mi1e topographic quadrangle maps.

B. Air (3 hours)

1. Observations of various intensities of windthrow and beetle damage

2. Check of map sense using aeronautical charts

3. Check of general air adaptability

C. Navigation (3 hours)

1. Tracking on quadrangle sheets at 1,500-2,000 feet over relatively flat terrain with good land marks (1½ hours)

2. Tracking on quadrangle maps at 1,000 feet over rough terrain with good land marks (1½ hours)

Intensive Training (6 hours)

D. Combination tracking and mapping windthrow or beetle kill at 1,000 feet on areas with good detail (1½ hours)

E. Combination tracking and mapping windthrow or beetle kill on areas with limited roads and cultural detail (1½ hours)

F. Mapping of windthrow and beetle-kill on test area containing known amount of damage (1½ hours)

G. Mapping of windthrow and beetle kill on areas of difficult terrain and heavy damage (1½ hours)

The first step in the training was to informally get together four or five of the prospective observers as they reported to Portland for assignment to provide them with survey manuals and discuss the purpose of the survey and how it would be done. Following this orientation they were shown colored slides of the beetle and blowdown damage and mapping procedures to be used were described. It is well to emphasize the value of slides and photographs for training. Even though the survey objectives were described in the operations manual and had been discussed at some length verbally it was not until the men saw the photographs that they clearly grasped the problem at hand.

Samples of the 1"-to-the-mile scale topographic quadrangle maps to be used for the aerial mapping were also provided to the observers for study. Although most of the men were experienced in using maps of this type generally it had been some time since they had done so and a short period of brushing-up before using them in the air was welcomed.

Following the ground orientation the observers were taken for flights over an area near Prairie Peak that had been used for the technique development studies and on which there were blowdown patches of known acreage and intensity of damage percent of stand blown down. Large patches of beetle-killed timber were also present in this area. By viewing these areas of known damage the observers could for example adjust their sights to what a patch of 20 acres of 50 percent blowdown looked like both on map and as seen from 1,000 feet above the terrain.

As they flew to and from the test area on their first flights the observers were provided with standard Aerial Navigation Charts on which to map the course of flight. Since these maps show only major physical features such as rivers, highways and towns they serve well as a starting point in developing navigation and tracking sense.

The next step in the training sequence involved teaching the trainees to follow course on predetermined flight lines on the quadrangle maps. The maps were mounted on 15" x 17" aluminum sheets and covered with transparent Friskit paper that could be erased thus saving much time in preparing new maps for each observer. Areas with easily recognized topography were flown first. Training then progressed to more difficult terrain as the observers gained experience. Either the technical advisor or chief observer flew with two trainees on these flights and by using known check points could both coach them and test their tracking accuracy.

As shown in the training outline the intensive training was divided into four phases all involving combination of tracking and mapping. Flights followed predetermined flight lines and progressed with each phase to areas of rougher terrain and more intensive damage by wind or beetles or both. The third area mapped during this sequence as the aforementioned Prairie Peak test area where ground cruises of the tree mortality had been made This was the only area on which an exact evaluation of the mapping proficiency of the individual observers could be made and for that reason was of great value both in the training and in evaluating the ability of men.

For the final training flight crews that would fly together on the operational survey were organized. Senior observers were appointed and an area to be practice-mapped was assigned. By practicing together as crews the men were able to work out many details of coordination prior to their first operational flight.

Pilot Training:

The high caliber of the pilots used on the survey contributed greatly to the success of the operations. Had these men not had great skill and ability to readily grasp this difficult type of flying the aerial phase of the survey would not have progressed as rapidly nor with as good results.

Pilot training was quite similar in its early stages to that of the aerial observers. However since all the pilots were experienced in navigation on small-scale aeronautical charts basic aerial navigation training was not required. The first training phase therefore consisted of flights in which the chief pilot flew along flight lines at the normal survey speed and at the proper elevation above the ground while the prospective survey pilot examined the topographic map and tracked his course along the predetermined flight lines Particular attention was focused upon the relationship of actual ground features to the topographic details on the maps. Most pilots readily grasped the tracking technique using either planimetric or topographic maps. The next phase was for the new survey pilot to practice the triple job of flying the airplane safely at the required air speed and altitude recognizing his exact position on the map at all times and flying the plane precisely along the flight lines inscribed on the map. It was the consensus of all pilots that this particular type of flying required more concentration and skill than any they had ever undertaken. Some pilots were eliminated because they were unable to qualify for the survey flying even after considerable practice. Pilots who did qualify were of the highest caliber.

As soon as the survey pilot had mastered the required techniques for "grid-iron" flying in cardinal directions he started practice flights with three aerial observers as an aerial survey team The pilot practiced with the observers on these flights until all members of the team had completed their training and developed into an efficient survey unit.

The pilots were given one additional training flight with the chief pilot. This was done to provide instruction in the contour flying that was used in the deeply dissected terrain of the Cascades areas. Precautions to avoid downdrafts to approach ridges properly and maintain adequate clearance and to maintain adequate air speeds at all elevations were stressed as important in maintaining maximum safety at all times.

. . .

Airplane and Equipment:

The make and model of aircraft used on the project was the Cessna 170-B. Five of these planes were used for the job, four of which were contracted and used on the operational survey. The fifth plane, property of the Bureau of Entomology and Planet Quarantine, was used for scouting, checking of mapping accuracy, weather flights and standby. Characteristics which make this airplane outstanding for work of this kind are listed below.

1. *Excellent forward and lateral visibility for observing.*
2. *Slow cruising speeds of 50 to 60 miles per hour.*
3. *Large flaps allow takeoffs and landings from small fields, plus outstanding rate of climb in emergencies.*
4. *Slow landing speed of approximately 40 M.P.H. plus all-metal construction provides added safety in case of crash landings.*
5. *Large cabin provides critically needed space for handling of maps and comfort of observers on long mapping flights.*[115]

From the 1952 *Annual Report* by the Pacific Northwest Forest and Range Experiment Station (PNFRES):

Report by the Division of Forest Economics, PNFRES
Cooperative Blowdown-Bark Beetle Survey

During the early part of 1952 it became apparent that a serious epidemic of the Douglas-fir bark beetle was shaping up. During February and March a joint aerial reconnaissance survey was made by the U.S. Bureau of Entomology's Portland Forest Insect Laboratory, the Oregon State Board of Forestry, and the Weyerhaeuser Timber Company. This survey found that there was detectable infestation on somewhat over 3 million acres in western Oregon and a small portion of southwestern Washington. It was known that during the winter of 1951-1952 there had been storms especially over the Coast Range of Oregon which had produced a substantial amount of blowdown. It was apparent to the entomologists and others who had followed the course of events that a serious situation was in the making.

Through efforts of the Insect Laboratory and the Forest Service regional office here, as well as through efforts of the Northwest Forest Pest Action Committee, this development was called to the attention of the Washington offices of the Forest Service and of the BEPQ. Early in May, the Division of Forest Economics [PNFRES] was instructed to collaborate with the Portland Forest Insect Laboratory [BEPQ] in formulating plans for and carrying out a survey to determine the location and extent of the acreage and volume involved in this infestation.

Direct control of the beetles is considered infeasible because bark beetles cannot be controlled by generalized spraying and the cost of felling and treating each infested tree would be exorbitant. However, removal of fire-killed or blown-down timber before it is infested or while beetles are still in it has definite control effects. Consequently, an additional purpose of the survey was considered to be obtaining information on the location of the infestation rapidly and getting that information promptly into the hands of forest landowners and forest land managers who could influence the start of salvage logging.

Results of the survey showed that there were 201,800 acres of blowdown that occurred during the winter of 1951-1952 of a sufficiently concentrated character so that it could be identified and mapped from the air. The results also showed that a net volume of almost exactly 1 billion board feet, log scale, had been killed by beetles up to the time of the survey in July. The net volume of timber blown down in the storms of the winter of 1951-52 totaled 8.9 billion board feet, log scale. Of this volume, 7.4 billion board feet occurred as scattered individual trees and small groups, important as a springboard for further spread of the infestation but mostly too scattered to form a basis for salvage logging.

[115]Greeley, A.W.; Wright, K.H.; Pope, R.B. 1953. Final report on the 1952 blowdown bark beetle survey in the Douglas-fir region of Oregon and Washington. USFS, PNFRES, and BEPQ, Portland Forest Insect Laboratory. 30p.

Further heavy killing may be expected even without additional blowdown. It is not unreasonable to expect that an additional 5 billion board feet will be damaged.

The technique used in this survey was built around flying mappers who mapped the location of blowdown and beetle kill, supplemented by ground cruisers who measured survey plots to sample the various classes of blowdown. The survey did not use aerial photographs. Airplanes used were all four-place Cessna 170-B's which were selected because of their maneuverability, their ability to fly slowly but safely, and their good visibility characteristics. Prior to flying, maps were prepared on which flight lines to be flown were laid out either at one-mile intervals, two-mile intervals, or on the contour. Crew members had identical maps of the area the crew was to fly each day. It was the job of the pilot to fly the flight line and do it safely. The man sitting beside the pilot in the front seat mapped beetle-kill groups. The two men in the rear seat of the plane mapped blowdown, each man mapping on his side.

*Since a purpose of the survey was to get this detailed information as quickly as possible into the hands of landowners and land managers the job was only partly done when the flying had been completed. As the flying mappers completed each map, draftsmen took over and prepared the maps for publication. Published maps were placed in the hands of those who could make effective use of the information by early October. A 10-page summary entitled "*Summary Statement on the 1952 Blowdown-Bark-Beetle-Survey in the Douglas-Fir Region of Oregon and Washington*" was published in late October. This statement briefly summarized the findings of the survey and showed by generalized maps the location of the infested areas and also of the 1951-52 blowdown. A final report on the project was in preparation at the end of the year.*

This was a fully cooperative project, under the over-all leadership of the Station's Division of Forest Economics. The planning and supervision were done jointly by the Portland Forest Insect Laboratory and by the Division of Forest Economics. Personnel assigned to the project totaled 36 and came from the Forest Insect Laboratory, from Region 6 of the U.S. Forest Service, from Region 1 of the Bureau of Land Management, from the Oregon State Board of Forestry, from the Industrial Forestry Association, from the Willamette Valley Tree Farm Management Service Inc., from the U.S. Weather Bureau, and from the Pacific Northwest Forest and Range Experiment Station. In addition, Region 7 of the Soil Conservation Service multilithed the maps, and valuable aid in the preparation of reports was received from the Industrial Forestry Association.

The project cost approximately $83,000 of which $10,000 was contributed in cash by the Oregon State Board of Forestry. Approximately $11,000 came in services and salaries contributed by the various organizations participating, including time and transportation of four men donated outright for the entire project by the Oregon State Board of Forestry. The balance, approximately $62,000 came from pest control funds appropriated to the U.S. Forest Service and allotted to the station for this survey.[116]

From the 1952 WFIWC proceedings:

Page 34:
A.T. Davison: *One of my jobs in the Portland laboratory is to work with the lumber industry as a means of getting their support for forest insect survey work. We need a liaison between the public and ourselves. We want to develop public relations to get better awareness of the insects we have in our area. Through the effort of the lumber associations we have been able to get that information out, and to enlist their aid in the surveys.*

The Douglas-fir beetle in Canada and the Pacific Northwest
Page 46:
K. Wright: *In our region in Oregon and Washington the epidemic infestation is very widespread. When a survey was made last summer there was somewhat over one billion feet killed in 1951. The damage is in mature stands and in old growth virgin stands as old as the fir in many areas. We can trace the infestation back to the windstorms of 1949 and 1950. There was a heavy infestation by beetles in the following year which spread out into the greener timber. The problem is so bad at the present time because of windstorms and with an epidemic already in progress we are sure the thing will expand a great deal more. As to how we have detected and evaluated the damage, we have done this by aerial survey. This tied down the boundaries. We did evaluation survey again using aircraft – used four aeroplanes and flew one mile apart. Mappers mapped locations of blowdown and beetle killed timber on one inch to the mile maps. Various stands*

[116]PNFRES. 1953. Annual report 1952. Portland, OR. p. 6-9.

were sampled on the ground to correlate the aerial observation with the actual trees. As to an assessment of the current status of the outbreak, it has been primarily by damage appraisal. The 1952 loss will be easing up sometime this fall but we won't know until next spring anything about the size of the area and the volume of timber involved. It appears some form of aerial work is the only way to go about it.[117]

1953:

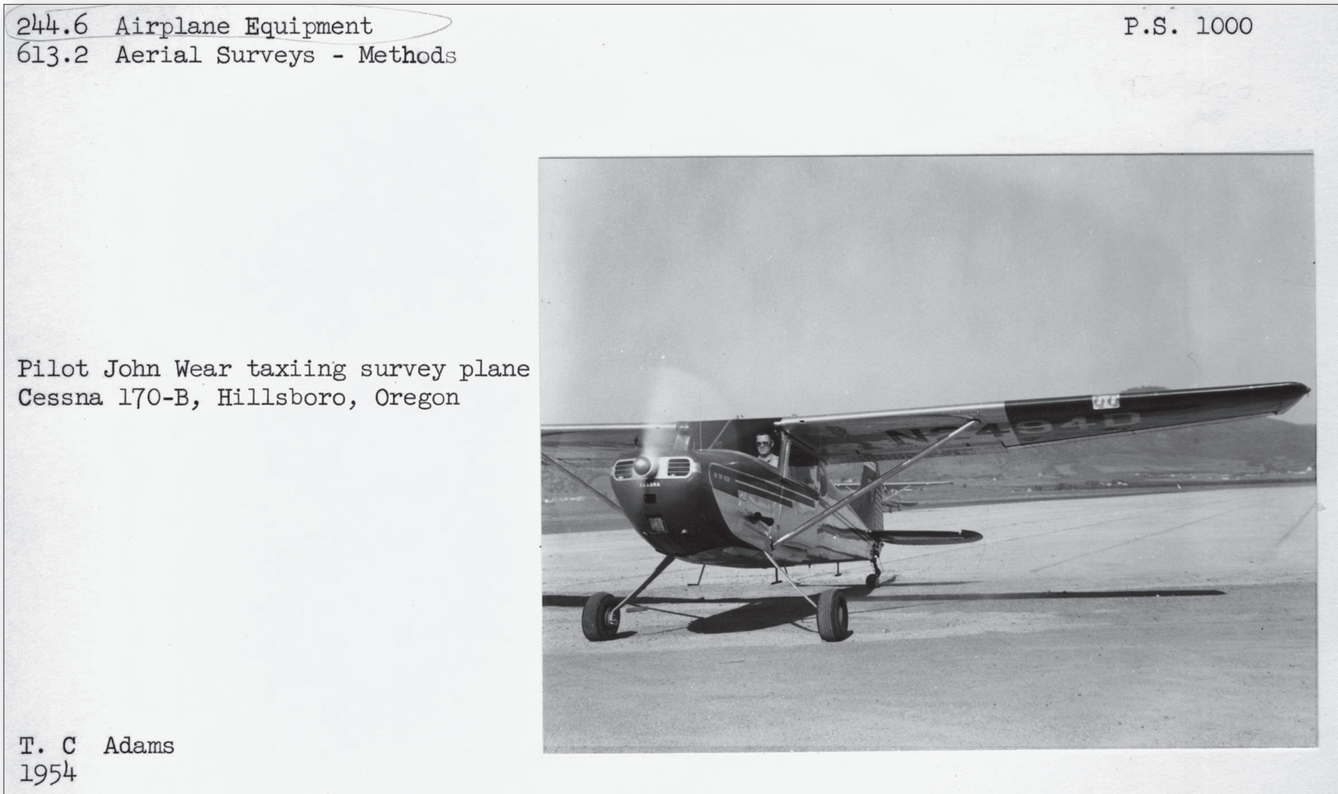


Figure 70. *Pilot John Wear taxiing survey plane Cessna 170-B (N2494D). Hillsboro, Oregon, 1954. Photo by T.C. Adams. USFS Portland Station Collection, PS-1000.*

From the PNFRES 1953 *Annual Report*:

Forest Insect Surveys

Two cooperative surveys were conducted in 1953 to detect and evaluate forest insect epidemics in Oregon and Washington.

The regular annual survey was made cooperatively with the Oregon State Board of Forestry, Washington State Division of Forestry, and many individual foresters, both public and private. This survey covered 47,300,000 acres of forest land in Oregon and Washington, leaving un-surveyed only 1,600,000 acres in southwestern Oregon. The findings were reviewed and acted upon by the Northwest Forest Pest Action Committee. A comprehensive report regarding the principle outbreaks has been prepared and distributed. More detailed information is on file.

A special aerial and ground survey of the Douglas-fir region, to record the spread and intensity of the bark-beetle-blowdown problem in 1953, was made cooperatively with the Bureau of Land Management, Oregon State Board of Forestry, Washington State Division of Forestry, and the station's Division of Forest Economics. The ground sampling to measure blowdown was done in the same way as in 1952. Aerial photo sample plots were substituted for sketch mapping to estimate the amount of beetle killed timber. The data have been only partially analyzed. A special report will be prepared.

[117]WFIWC proceedings. December 8-9, 1952. Victoria, BC. p. 34 and 46.

The highlights of the survey findings regarding the most destructive insects are included in the following sections. For more detailed information, refer to the survey report or make specific inquiry.

...

Work on the manual for making aerial surveys in the Northwest was continued. Plans call for the issuance of this manual prior to the survey season of 1954.[118]

From the January 1953 Journal of Forestry, *Forestry News*:

Beetle Plague and Windstorms Damage Oregon Douglas-firs

A double-pronged catastrophe struck western Oregon's Douglas-fir forests in 1952, killing more than 10 billion board feet of prime timber. W.D. Hagenstein reported to the interagency membership of the Northwest Forest Pest Action Committee recently that the Douglas-fir beetle teamed up with a record windstorm in spreading destruction across 2 million acres of the state's finest forestlands.

The beetle killed about 1 billion feet of timber, according to Hagenstein, chairman of the group's Douglas-fir beetle subcommittee. Another 9 billion board feet was blown over by winds of hurricane velocity in the winter of 1951-1952, and additional losses may run from 2 to 5 billion board feet, his report said.

Much of the blow-down timber, an ideal breeding place, is beetle infested and, Hagenstein told the committee, its salvage should receive top priority, since there is no known effective spray for the pest.

Hagenstein based his report on surveys of timber killed on a 13,500 acre area by the Pacific Northwest Forest and Range Experiment Station and the U.S. Forest Insect Laboratory at Portland, which reveal that the scattered locations of the heaviest blow-down and beetle-kill in roadless wilderness areas presents an exceedingly difficult salvage operation that will be the Oregon Douglas-fir industry's most pressing problem for several years.

He urged loggers and landowners to initiate large-scale salvage programs without delay because timber deteriorates rapidly once attacked by the beetles, and should be taken out as rapidly as roads can be built.

R.L. Furniss, entomologist-in-charge at the U.S. Forest Insect Laboratory in Portland, told the committee that additional heavy killing by the beetle is expected in the next two or three years, and that the situation could worsen still more if winter storms blow down more timber.

Fire in this vast area of dead and dying timber also menaces western Oregon's forests, Hagenstein pointed out, since blow-down is exceptionally heavy along windswept ridges.

Combined efforts of private and public forest agencies are required to develop the essential road system into the most heavily infested areas.

Landowners have been urged to survey property annually to keep posted both on the extent of the spread of the beetle and additional wind damage.

The Douglas-fir beetle has always been present in the northwestern forests but reached epidemic proportions only when a vast breeding ground was provided by the billions of feet of wind-thrown timber.[119]

From the *Report of Forest Insect Surveys in Oregon and Washington Season of 1953:*

The 1953 Douglas-fir bark beetle-blowdown survey, under the supervision of Mr. R.B. Pope of the Pacific Northwest Forest and Range Experiment Station, was a cooperative project between the Oregon State Board of Forestry, Washington State Division of Forestry, Bureau of Land Management, Pacific Northwest Forest and Range Experiment Station, and

[118]PNFRES. 1954. Annual report – 1953. Portland, OR. p.24.

[119]Journal of Forestry. 1953. Forestry News. 51(1):77.

> *the Bureau of Entomology and Plant Quarantine. A list of personnel on this project will be recorded in the report covering the findings of this survey.*
>
> *The 1953 regional aerial survey was a cooperative undertaking between the Weyerhaeuser Timber Company, Oregon State Board of Forestry, Washington State Division of Forestry, and the Bureau of Entomology and Plant Quarantine. The forests of Oregon were surveyed with the Oregon State Board of Forestry Cessna 170, with a crew consisting of Mr. A. Larsen, pilot and observer and Mr. M. Ramsdell pilot for the State and Mr. W.J. Buckhorn, observer and mapper. Most of the Washington forests were surveyed with a Cessna 180 of the Bureau of Entomology and Plant Quarantine with a crew consisting of Mr. R.M. Lamoureaux, pilot, and Mr. W.J. Buckhorn, observer and mapper, both of the Bureau, and Mr. F. Murphy of the Washington State Division of Forestry, observer and radio operator.*
>
> *The Cessna 170B of the Weyerhaeuser Timber Company, with a crew consisting of Mr. Bartel, pilot, and Mr. P. Lauterbach [Figure 62], observer, for the company and Mr. W.J. Buckhorn as observer and mapper, covered the hemlock stands of western Washington.*
>
> *The ground checking of the regional survey findings was done by Mr. A. Gruba of the Oregon State Board of Forestry, Messrs. W.J. Buckhorn and P.W. Orr of the Bureau of Entomology and Plant Quarantine.*
> …
> *The compilation of the regional survey findings was done by Messrs. A. Gruba, A. Larsen, D. McComb, M. Ramsdell of the Oregon State Board of Forestry, and Mr. W.J. Buckhorn, V. Poole of the Bureau of Entomology and Plant Quarantine. The large-scaled maps, showing the 1953 infestations were prepared by Messrs. Gruba and Ramsdell and the base maps for Maps 1 and 2 in this report were prepared by Messrs. A. Larsen, W.J. Buckhorn, and J.F. Wear.*[120]

ODF's Insect and Disease Section was established in Salem, Oregon.

The Official Register of the US shows A.J. Jaenicke as: North Pacific National Forest Region, Division of Timber Management, Chief, Cutting Practices, Insect and Disease Control Section.[121]

Figure 62. *Weyerhaeuser forester and aerial surveyor Paul G. Lauterbach examining cage used to collect emerging Douglas-fir beetles. Coos County, Oregon. August 1952. USFS Portland Station Collection, PS-1688.*

[120]OSBF; BEPQ. 1953. Report of forest insect surveys in Oregon and Washington season of 1953. p. 25.

[121]US Civil Service Commission. May 1, 1953. Official register of the United States. Washington, DC: Government Printing Office. p. 355.

Chapter 5
The survey moves to Forest Service Research – 1954-1961

Federal administrative survey responsibility: USDA Forest Service, Research branch, Pacific Northwest Forest and Range Experiment Station, Forest Insect Research

BEPQ was abolished by Secretary of Agriculture's Memorandum No. 1320, suppl. 4, November 2, 1953.

From the PNFRES 1953 *Annual Report*:

> *On October 13 [1953] Secretary Ezra T. Benson announced plans for reorganizing the USDA. … Responsibility for insect and disease research was given to the Forest Service. In the Pacific Northwest, programs, personnel and facilities of the Portland Forest Insect Laboratory, Bureau of Entomology and Plant Quarantine, and the Portland Division of Forest Pathology, Bureau of Plant Industry, Soils and Agricultural Engineering are transferred to the station where they will be respectively the Division of Forest Insect Research and the Division of Forest Disease Research. Division of Insect Research will be headed by R.L. Furniss and consists of 8 technical personnel and the second is headed by J.L. Bedwell and consists of 5 technical personnel. Although the transfer did not become effective until Janurary 3, 1954, it was considered appropriate to record 1953 activities and accomplishments … in this report.*[122]

Station Director Robert Cowlin recalled the 'move' thus:

> *The transfer of the forest insect and forest disease groups was made effective December 20, 1953 and the Divisions of Forest Insect Research and Forest Disease Research were official members of the Station before the close of 1953 – before Christmas for that matter, a cause for celebration and strengthening of the Station generally. Upon transfer, the Forest Insect Division staff consisted of Robert L. Furniss, division chief; John M. Whiteside, Walter J. Buckhorn, Wm. K. Coulter, Kenneth H. Wright, and Wm. F. McCambridge, entomologists; John F. Wear, air pilot and research forester; and Wilma M. Taylor, clerk-stenographer. The Forest Disease Division staff consisted of Dr. Jesse L. Bedwell, Dr. Thomas W. Childs, George Harvey, and Dr. Ernest Wright, pathologists, and Zella A. Manwaren, clerk-stenographer. The activities of the Division of Forest Insect Research consisted of three major lines of work: research, forest insect surveys, and technical supervision of forest insect control projects.*[123]

For additional administrative details, see Appendix 2.

With the move to the Forest Service, the entomologists also gained access to the Station's off-site work/lab space at the old Sellwood Carmen's Clubhouse located at 8825 SE 11th, Portland, Oregon. The staff used this building for laboratory work, photography and print processing, and as an insectary, shop, storage, and vehicle maintenance space (for further details see Appendix 6).

[122]PNFRES. 1954. Annual report – 1953. Portland, OR. p. 2.

[123]Cowlin, R.W. 1988. Federal forest research in the Pacific Northwest. USFS, Pacific Northwest Research Station. p.148.

1954:

Figure 71. *Pilot John F. Wear and photographer Wally C. Guy. 1954. Photo courtesy of Peter Orr.*

Figure 72. *Contract pilot Joe Harrell and aerial observer Walter J. Buckhorn with a Cessna 170 at the Eugene Air Park. July 1954. Photo courtesy of Peter Orr.*

From *Report of Forest Insect Surveys in Oregon and Washington – Season of 1954*:

> *Three cooperative forest insect surveys were conducted in Region 6 in 1954: First – the regular regional aerial and ground survey of the entire forested area recorded data on all major forest insect pests; second – a special survey of the silver fir beetle infestation in western Washington; and third – the aerial re-photography of 74 plots in the Douglas-fir region provided data on the status of the Douglas-fir beetle and the volume losses in the region.*
> …
> *The 1954 regional aerial survey was a cooperative project between the Oregon State Board of Forestry, the U.S.D.A Agricultural Research Service, and the Pacific Northwest Forest and Range Experiment Station. Messrs. W.J. Buckhorn and P.W. Orr of the Station were observers and mappers during the aerial phase of the survey in Oregon and Washington. The Blue Mountain Area of the two states was covered in the Oregon State Board of Forestry Cessna 170, with Mr. A.T. Larsen pilot for the state. The rest of Oregon was covered in a Cessna 170 rented by the Station with Mr. J. Harrell [Figure 72] employed as a pilot for the period July 12-28, 1954. The coastal area of Washington was covered in the Station's Cessna 170, with Mr. J.F. Wear as pilot. The rest of Washington was surveyed in a Cessna 180, obtained from the U.S.D.A. Agricultural Research Service on a cost basis, with Mr. N. Meyer, of that agency as pilot [Figures 73 and 74]. Several foresters of private companies conducted aerial surveys of their holdings, particularly Mr. [Paul G.] Lauterbach of the Weyerhaeuser Timber Company, and made their survey findings available to the Station.*
>
> *The compilation of the region's survey findings was done by Messrs. A. Gruba, A. Larsen, and D. Sheridan of the Oregon State Board of Forestry and Messrs. W.J. Buckhorn, W.K. Coulter, and K.H. Wright of the Station. The large-scale maps of the 1954 infestations were prepared by Messrs. Gruba and Buckhorn. Maps 1 and 2 in this report were prepared under the direction of Mrs. K. Flaherty of the Station.*[124]

Figure 73. *USDA, Agricultural Research Service, Plant Pest Control Branch Cessna 180 used during 1954 Washington surveys. Pilot N. Meyer. Photo courtesy of Peter Orr.*

From PNFRES *Annual Report – 1954*:

> **Forest Insect Surveys**
> Pages 30-31:
>
> *The regular aerial and ground survey of the 48 million forested acres in the region was cooperatively conducted with the Oregon State Board of Forestry, Washington State Division of Forestry, and many public and private foresters. Epidemic infestations were recorded on 7,704,120 acres, or about 16 percent of the region's forest land. A report presenting the principle findings was prepared and given general distribution. The report was reviewed by the Northwest Forest Pest Action Committee at its annual meeting on November 1, 1954, and was the basis for their recommendations for control in 1955.*

[124]OSBF; PNFRES. 1954. Report of forest insect surveys in Oregon and Washington season of 1954. Portland, OR. p. 1 and 29.

A special survey of the epidemic of silver fir beetles causing severe losses of Pacific silver fir in western Washington was made cooperatively by members of the Silver Fir Beetle Sub-Committee of the Northwest Forest Pest Action Committee. Results of this survey and work of the sub-committee in 1954 were summarized in a report presented at the annual meeting of the Pest Action Committee.

Aerial re-photography of 75 plots in the Douglas-fir region provided data on the status of the Douglas-fir beetle outbreak and the amount of timber killed by this insect. The data have been partially analyzed and a summary has been prepared. A more detailed report will be issued in the near future.

Improvement of Survey Methods
Page 35:

Some changes in the methods of recording mortality information during aerial survey were developed in 1954. The inclusion of these methods in the aerial survey manual have delayed its issuance until early 1955.[125]

Figure 74. *Walter J. Buckhorn (ground) and Pilot N. Meyer with the USDA, Agricultural Research Service, Plant Pest Control Branch Cessna 180 used during the 1954 Washington surveys. Photo courtesy of Peter Orr.*

ODF:

Insect and Disease Section of the Oregon State Board of Forestry – Organization and Function

Surveys: In cooperation with the Pacific Northwest Forest and Range Experiment Station, an annual survey is made of all the forested area of the state to check for new insect outbreaks, increased areas of known infestations and degrees of intensity. An observation plane (Cessna 170B) with a Forester-Pilot is furnished by the state. The Experiment Station usually provides trained observers. This survey takes about 100 hours of flying time per year.

The state also has two survey foresters who ground check infested areas located by the aerial survey for correctness of infestation boundaries, intensity, and if necessary, the cause of damage. Help is provided in preparation of maps and tables showing damage by insect species or disease in acres and intensity. These maps are available to interested agencies and companies.

In addition, the state provides men in an annual check on established plots located throughout areas where no known infestation exists. This is a safeguard against low intensity attacks that may not be seen from the air.[126]

[125]PNFRES. 1955. Annual Report - 1954. Portland, OR

[126]OSBF. 1954. OSBF organization and function. December 7, 1954. Hardcopy, R6 aerial survey program files. Sandy, OR.

Oregon Cooperative Forest Pest Control Program, 1954:

In 1948, timber owners, both public and private became gravely concerned about the rapid spread of the spruce budworm infestation. Individual control was not the answer as it embraces all types of ownership. Because of a common problem, a meeting of all interested agencies and owners was held on September 8th and a committee formed to coordinate the control work. This was known as the "Spruce Budworm Action Committee." In 1951 a tremendous volume of timber was wind thrown in the Douglas-fir belt of the state. This resulted in a bark beetle epidemic that resulted in a total loss of blowdown and beetle kill estimated between 13 and 14 billion board feet. The Committee now was confronted with a new problem that required coordinated effort of all owners. A regional survey was needed to locate and estimate the volume of its effected timber and to inaugurate a concerted effort for salvage. In 1952 the Committee broadened its scope of activities and became the "Northwest Forest Pest Action Committee." It became a clearing house for all forest pest problems. The Committee has developed slowly, broadening its objectives and functions as conditions and development demanded. Its objectives are to provide a vehicle for cooperative effort in combating forest insects and diseases and to coordinate activities that duplication of effort may be eliminated [and] to present a united front for appropriation to be used on control and research. Some of its functions are: 1) Review and recommend direct control project based on findings from the aerial detection surveys, 2) Investigate and recommend priorities for research, 3) Solicitate [sic] aid for research from possible interested companies and attempt to interest educational institutions that have the facilities to do needed research, and 4) Act through the Western Forest Pest Committee for congressional appropriations for pest control.

The State Forestry Department takes an active part in the Northwest Forest Pest Action Committee and its many sub-committees. It has and will continue to provide 70-80 hours flying time for its plane and pilot on the annual detection survey made cooperatively with the Pacific Northwest Forest and Range Experiment Station and private companies. It cooperates on ground checking and the preparation of the annual survey report which is made available to all public and private companies.[127]

1955:

John F. Wear and Walter J. Buckhorn published the *Organization and Conduct of Forest Insect Aerial Surveys in Oregon and Washington* in March of 1955. This 46 page manual stands as the original authority on conducting aerial insect and disease surveys. Figures 75-81 (and other photos throughout this report) were taken to help illustrate the manual.

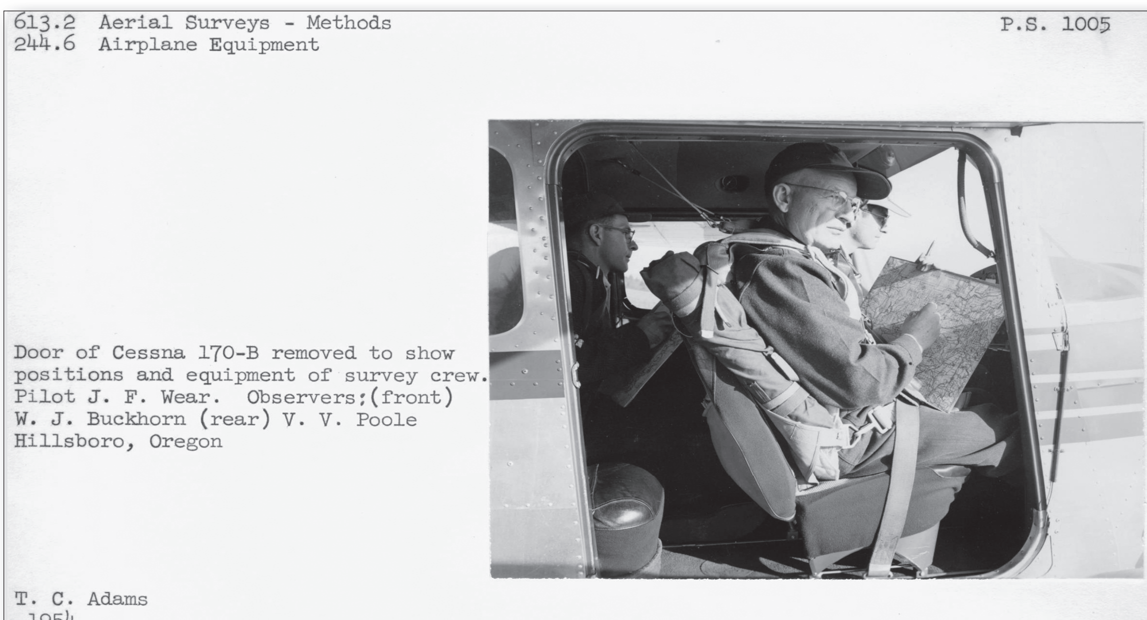


Figure 75. *Door of Cessna 170-B removed to show positions and equipment of survey crew. Pilot John F. Wear. Observers: (front) W.J. Buckhorn, and (rear) V.V. Poole. Hillsboro, Oregon. 1954. Photo by T.C. Adams. USFS Portland Station Collection, PS-1005.*

[127]OSBF report.1954.Oregon cooperative forest pest control program. p. 3. Hardcopy, R6 aerial survey program files. Sandy, OR.

613.2 Aerial Surveys - Methods P.S. 1002
244.6 Airplane Equipment

W. J. Buckhorn tying down survey
plane Cessna 170-B
Hillsboro, Oregon

T. C. Adams
1954

Figure 76. *W.J. Buckhorn tying down survey plane Cessna 170-B. Hillsboro, Oregon. 1954. Photo by T.C. Adams. USFS Portland Station Collection, PS-1002.*

613.2 Aerial Survey - Methods P.S. 1003
244.6 Airplane Equipment

W. J. Buckhorn pulling emergency
door release on survey plane
Cessna 170-B.
Hillsboro, Oregon

T. C. Adams
1954

Figure 77. *W.J. Buckhorn pulling emergency door release on survey plane Cessna 170-B. Hillsboro, Oregon. 1954. Photo by T.C. Adams. USFS Portland Station Collection, PS-1003.*

613.2 Aerial Surveys - Methods
244.6 Airplane Equipment

P.S. 1004

Details of emergency door
release on survey plane
Cessna 170-B.
Hillsboro, Oregon

T. C. Adams
1954

Figure 78. *Details of W.J. Buckhorn pulling emergency door release on survey plane Cessna 170-B. Hillsboro, Oregon. 1954. Photo by T.C. Adams. USFS Portland Station Collection, PS-1004.*

613.2 Aerial Surveys - Methods

P. S.1008

Aerial survey crew being briefed on
weather conditions. W. J. Buckhorn,
Ben Spada. Portland International
Airport.

T C Adams
1954

Figure 79. *Aerial survey crew being briefed on weather conditions. Left to right: Unidentified weatherman, W.J. Buckhorn, J.F. Wear, and Ben Spada. Portland International Airport. 1954. Photo by T.C. Adams. USFS Portland Station Collection, PS-1008.*

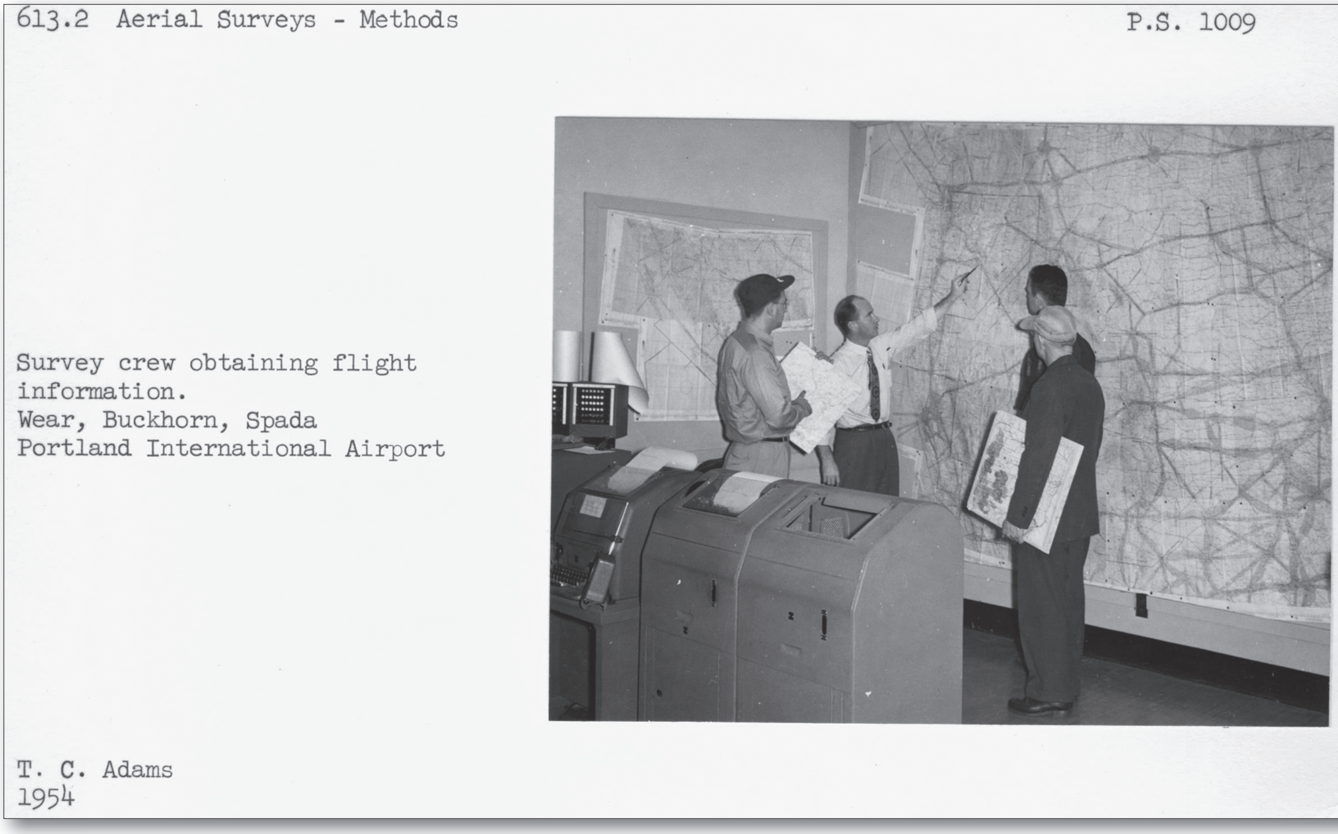


Figure 80. *Aerial survey crew obtaining flight information. Left to right: Ben Spada, Unidentified airport personnel, W.J. Buckhorn, and J.F. Wear. Portland International Airport. 1954. Photo by T.C. Adams. USFS Portland Station Collection, PS-1009.*

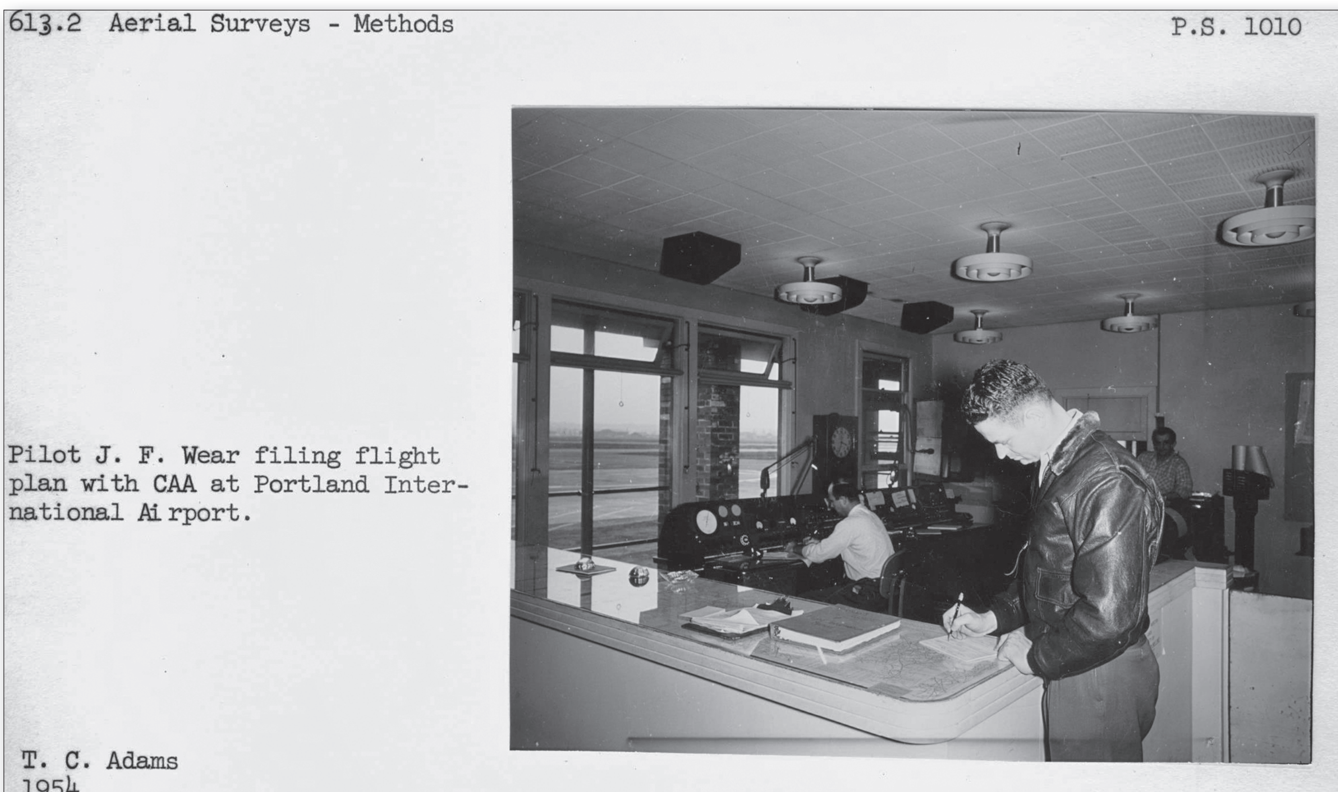


Figure 81. *Pilot J.F. Wear filing flight plan with CAA at Portland International Airport. 1954. Photo by T.C. Adams. USFS Portland Station Collection, PS-1010.*

From the *Report of Forest Insect Surveys in Oregon and Washington Season of 1955*:

The 1955 forest insect surveys were a cooperative project coordinated by the Pacific Northwest Forest and Range Experiment Station.

Aerial Surveys: *The Oregon State Board of Forestry provided a Cessna 170B and the services of Mr. A.T. Larsen, pilot for surveys with the Station of the eastern Oregon Cascades Area and northwestern Oregon.*

The Washington State Division of Forestry made $1,000 available to the Station for completion of surveys in Washington, without which the survey could not have been completed.

Weyerhaeuser Timber Company provided a Cessna 170B and the services of Mr. P.G. Lauterbach, observer and mapper and Pilot C.R. Dunbar for surveys of company lands.

The Station rented a Cessna 170B and employed Pilot J. Harrell during the period of July 6-August 12 for surveys of the following areas: Western Oregon, western Washington, eastern Washington, Blue Mountains. The coastal area of Washington was surveyed with the Station's Cessna 170B with pilot J.F. Wear. Messrs. W.J. Buckhorn and P.W. Orr were observers and mappers during the Station's surveys.

…

Ground Surveys: *Messrs. E. Dockerell, R. Ketchum, and H. Stolaas, Washington State Division of Forestry assisted in the ground-checking of aerial survey findings in western Washington. Messrs. W.J. Buckhorn, V.M. Carolin, W.K. Coulter, P.W. Orr, G.M. Thomas, and K.H. Wright of the Station ground-checked the bulk of the aerial survey findings.*

Compilation of Survey Data: *Compilation of survey findings was completed by Mrs. M.L. Compton and A.T. Larsen, Oregon State Board of Forestry, and Messrs. W.J. Buckhorn and P.W. Orr. Maps for this report were prepared by P.W. Orr, Mrs. K. Flaherty and Mrs. I. Lohr. Typing and preparation of multilith plates was done by Mrs. W. Taylor [Figure 81a] and Mrs. N. Winans. Multilith reproduction was by Miss C.D. Tomlinson.*[128]

Figure 81a. *Wilma Taylor. 1960. Photo by Wally C. Guy. USFS Portland Station Collection, PS-3236.*

[128]PNFRES. 1955. Report of forest insect surveys in Oregon and Washington season of 1955. Portland, OR. p. 37.

The 1955 report also included a list of organizations involved with the Northwest Forest Pest Action Committee (later Council) (NFPAC):

The Northwest Forest Pest Action Committee, E.L. Kolbe, Chairman is composed of representatives of the following organizations:

Associated Forest Industries of Oregon
Industrial Forestry Association
Keep Oregon Green Association
Keep Washington Green Association
Oregon Extension Service
Oregon Forest Fire Association
Oregon State Board of Forestry
Oregon State College
Southern Oregon Conservation and Tree Farm Association
State College of Washington
Tree Farm Management Service
U.S. Bureau of Land Management
U.S. Forest Service
U.S. Office of Indian Affairs
U.S. Soil Conservation Service
University of Washington
Washington Forest Fire Association
Washington State Division of Forestry
Washington State Forestry Conference
Western Forest Industries Association
Western Forestry and Conservation Association
Western Pine Association[129]

The importance of NFPAC's role was emphasized in the article *How Forest Pests Upset Management Plans in the Douglas-fir Region*, by Royce O. Cornelius of the Weyerhaeuser Timber Company:

What We Have Learned:
From our experiences with forest pests in the Douglas-fir region we know that the following items are important in management planning:
…

3. Annual detection surveys should be an important part of the protection program on any forest area. Adequate surveys reveal windthrow areas and give early warning as to where timber is being killed or is likely to be killed by insects. This facilitates planning of sanitation salvage logging to reduce both insect damage and deterioration losses.
…
10. Above all else, the work of the Northwest Pest Action Committee and its subcommittees has shown that through unified, cooperative action forestry organizations can meet forest pest problems threatening forestry as a business in the Douglas-fir region.[130]

From PNFRES *Annual Report – 1955*:

Epidemic infestations of major insect pests in Oregon and Washington were detected and appraised through two cooperative surveys in 1955.

Regional aerial and ground surveys of over 45 million acres were cooperatively conducted with many private and public foresters … A marked decrease in losses caused by forest insects was found in 1955 over that reported the previous year. Some 2,248,820 acres of epidemic infestations were detected in 1955 as compared with 7,704,120 acres in 1954. A report

[129]PNFRES. 1955. Report of forest insect surveys in Oregon and Washington season of 1955. Portland, OR. p. 2.

[130]Cornelius, R.O. 1955. How forest pests upset management plans in the Douglas-fir Region. Journal of Forestry. 53(10):713.

presenting survey findings was prepared for distribution and review at the annual meeting of the Northwest Forest Pest Action Committee in October. The report was the basis for the committee's control recommendations for 1956.

The special survey of damage to Pacific silver fir by bark beetles was continued in cooperation with the Silver Fir Beetle Subcommittee of the Northwest Forest Pest Action Committee. Results of the survey and the work of the subcommittee were summarized and presented at the annual meeting of the parent committee. Work of the subcommittee included an incidental survey of areas of hemlock dying from unknown causes.[131]

After the BEPQ was abolished and the survey personnel moved to the U.S. Forest Service, Beal wrote another article outlining the new role of the Forest Service in the surveys. It also showed a desire to move away from extensive and intensive ground surveys and to rely more upon aerial detection surveys. From Beal and Hutchins 1955:

Insect and disease losses therefore are causing concern to all owners of forest lands. The Forest Service has a major responsibility in holding these losses to a minimum, not only on national forests, but also on all other forest lands, irrespective of ownership. To this end it conducts (1) research designed to develop more effective and economical prevention and control measures; (2) surveys to detect and appraise insect and disease outbreaks; and (3) control projects to check both endemic and epidemic losses to our timber resources.

Cooperation between state, private, and federal agencies is emphasized throughout all phases of this program.

…

Surveys for forest damage by insects and diseases are conducted both from the air and on the ground. Survey from the air is feasible when insects defoliate trees; or when they cause rapid changes in foliage color as they attack other parts of the tree. When tree diseases cause characteristic symptoms to develop in the crown of trees, as is the case of oak wilt or pole blight of western white pine, aerial surveys are also practicable.

However the prevalence of other insects, with different feeding habits, whose effects on trees are less readily discernible, must be determined from the ground. …

The Forest Service is investigating the maximum usefulness of the aerial surveys and the minimum amount of coverage needed in ground surveys to give dependable results. As new information is obtained, it is at once placed at the disposal of agencies and individuals to whom it might be helpful.[132]

Alex J. Jaenicke retired July 31, 1955:

Alex J. Jaenicke retired July 31 after more than 42 years with the U.S. Forest Service. Jaenicke's career has covered almost the entire span of the Forest Service, as he received his permanent appointment in 1912, seven years after the Service was formed. He is best known for his work in the Pacific Northwest to which he was transferred in 1916 from the Southwest.

He was one of ten persons in the nation and Canada in the professional conservationist class who received the 1955 Nash Motors Conservation Award, made for his accomplishments in the field of forest insect control.

Regional Forester J. Herbert Stone states that Jaenicke has participated prominently in nearly every large-scale forest insect control program in the West. From 1949 to the time of his retirement he was in charge of the Forest Service activities connected with the cooperative aerial spraying operations directed at the control of the spruce budworm epidemic which threatened extensive areas of Douglas-fir and white fir forests in Oregon and Washington. Under this operation almost four million acres have been successfully treated to date. He is also widely known for his contribution to the development of timber cutting practices, particularly in ponderosa pine forests. To a considerable degree, through his efforts what has become known as "sanitation-salvage" selective cutting in ponderosa pine stands has been perfected.

Jaenicke graduated from the forest school at Pennsylvania State University in 1912 and completed an additional year at Cornell University.[133]

[131]PNFRES. 1956. Annual report – 1955. Portland, OR. p. 32-33.

[132]Beal, J.A.; Hutchins, L.M. 1955. The role of the Forest Service in control of insects and diseases. Journal of Forestry. 53(2):129, 131.

[133]Journal of Forestry. 1955. Forestry news. 53(10):794-795.

1956:

Figure 82. *Discussion leaders, Northwest Forest Pest Action Committee, October 29, 1956. Dick Berry, C.H. Willison, R.L. Furniss, R.O. Cornelius, E.L. Kolbe, M.L. Compton, N.E. Bjorklund, D.R. Hopkins, W.D. Hagenstein, J.M. Whiteside, G.H. Schroeder. Photo by R.B. Pope. USFS Portland Station Collection, PS-1486.*

In October of 1956, Benton Howard was hired to replace Alex Jaenicke as head of Insect and Disease Control in R6 Division of Timber Management:

Benton Howard Moves to Northwest Forest Region:

Transfer and promotion of Benton Howard, assistant chief of blister rust control for the California Region of the U.S. Forest Service was announced recently by Regional Forester Chas. A. Connaughton. Mr. Howard's new position, effective in October, is chief of insect and disease control in the timber management division of the Northwest Region of the Forest Service with headquarters in Portland, Ore. Howard will be in charge of directing surveys[134] of forest insect and disease concentrations and the control work necessary to reduce losses in the forests of Oregon and Washington. White pine blister rust control will be a large part of his work. He has spent nearly 25 years in combating blister rust in California.[135]

[134]The surveys mentioned here are ground surveys, not aerial surveys; until July 1, 1961, the aerial surveys are still under the supervision of R.L. Furniss in Research.

[135]Journal of Forestry. 1956. Forestry news. 54(12):875.

From *Forest Insect Conditions in the Pacific Northwest – 1956*:

Aerial surveys:

Aerial surveys were again organized and conducted under the able leadership of Mr. W.J. Buckhorn. A total of 305.4 hours of flying time during the period of July 9-August 28 and six combinations of survey personnel were required to complete the surveys.

The Oregon State Board of Forestry provided the services of Mr. A.T. Larsen, pilot, and the State Cessna 170-B plane for 70 hours of survey time in Oregon. In addition, the State contracted with the Station for rental of the State plane for 503 hours and furnished the pilot to complete the Oregon surveys.

The Washington State Division of Forestry provided a forester, Mr. K. Turnbull, to be trained as a permanent aerial observer for the surveys in that state. He was trained by Mr. Buckhorn and accompanied him during 75.4 hours of survey in Washington.

The Weyerhaeuser Timber Company again provided their Cessna 170-B and the services of Mr. P.G. Lauterbach, observer, and Mr. C.R. Dunbar, pilot, for 70 hours of surveys on branch forests as part of the cooperative agreement. As in past years, the findings were turned over to the Station for inclusion in this regional summary. In addition, 40 hours were flown to detect any sizeable areas of windthrown trees on the branch forests.

The Station contracted with Skyways Inc. for 103.1 hours of flying. The company was low bidder on a request for the services of a Cessna 180 and pilot and furnished a nearly new plane and Mr. R. Alexander, pilot for surveys in most of Washington and a portion of Oregon. Messrs. W.J. Buckhorn and P.W. Orr were observers for the Station and J.F. Wear piloted the Station's Cessna 170-B during 12 hours of flying to detect hemlock looper damage. Infestations of the balsam woolly aphid received special attention in 1956. A detailed survey of the Gifford Pinchot N.F. and the fir stands in the Oregon Cascade Mountains was made during the Station's operation. Infestations on the Gifford Pinchot N.F. were plotted on a ½-inch-per-mile map and turned over to the Supervisor for planning salvage operations.

Ground surveys:

Personnel of the Division of Forest Insect Research ground checked the aerial survey findings and provided information on light infestations of several potentially serious insects.[136]

Figure 83. *John (Jack) M. Whiteside was head of insect surveys from ~1940-1959. USFS R6 Aerial Survey Program Collection.*

[136]PNFRES. 1957. Forest insect conditions in the Pacific Northwest – 1956. Portland, OR. p. 26-27.

Walter J. Buckhorn received a USDA Superior Service Award from the Secretary of Agriculture, Ezra Taft Benson, in Washington DC on June 5, 1956, *"For vision and leadership in pioneering and developing forest-insect aerial surveys in the States of Oregon and Washington."*[137]

Figure 84. *Walter J. Buckhorn and his wife, Bertha on May 31, 1956, leaving Portland via United Air Lines for Washington, DC to receive his Superior Service Award. The award was presented by the Secretary of Agriculture Ezra T. Benson at the Sylvan Theater on June 5, 1956. Photo by Robert L. Furniss. USFS Portland Station Collection, PS-1379.*

News of Buck's award in the Granite Falls Press of Snohomish, Washington:

Federal Researcher Honored

Walter J. Buckhorn, entomologist with the Forest Service's Pacific Northwest Forest Range Experiment Station at Portland, Tuesday was presented the Department of Agriculture's Superior Service Award by Secretary Ezra T. Benson.

*In government service for 34 years, Buckhorn was cited for "*Vision and leadership in forest insect aerial surveys in Oregon and Washington, and sustained contributions to forest insect surveys, control and research." *The presentation was made in Washington, DC.*

That most forest areas in the West are surveyed annually from the air to detect insect outbreaks is credited largely to Buckhorn's pioneering efforts. Early in his career, he advocated the use of airplanes for detection of outbreaks before they become too large to control and for locating dead and dying timber in need of salvage. Aerial mapping procedures he developed have been generally adopted by private, state and federal timber-managing agencies.

In 1947, Buckhorn developed and carried out the first comprehensive aerial survey of forest insect outbreaks in the West. From 1949 to 1955 he did most of the mapping for a successful 4-million acre spruce budworm spraying project in the Pacific Northwest.

The award also recognized Buckhorn's development over the years of forest insect research techniques and equipment.[138]

[137] USDA Honor Awards Ceremony Program. June 5, 1956, 10:30 am. Sylvan Theater, Washington, DC. Page 8.

[138] Granite Falls Press, Snohomish WA. Volume 10. June 21, 1956.

From *Spruce Budworm Control in Oregon and Washington 1949-1956*:

> *Reliable surveys are necessary for evaluating forest pest control needs. In 1947, the need for detailed information on the extent and severity of budworm infestations led to initiation of an annual regional survey program in the Pacific Northwest. Private, state and federal agencies have cooperated in this survey.*
>
> *In Oregon and Washington aerial surveys are conducted from about July 1 to September 15 to locate and map-in-place all epidemic centers of spruce budworm infestations. Since 1949, the entire 45 million acres of commercial forest land in the two states has been re-surveyed annually by a combination of gridiron and contour flying. We use a high-wing plane of the Cessna 180 type, two trained observers, and a pilot well versed in mountain flying. Most surveys are conducted 800-1,000 feet above the tree tops. Our aerial survey findings are carefully ground checked. These checks verify the identity of the insect or cause of the damage, and the degree of damage, and determine more accurately the infestation boundaries.*
>
> *Intensive ground surveys to locate incipient budworm infestations, not detectable from the air, have also been conducted throughout the western part of the region since 1949. An average of 2,000 plots has been examined each year by cooperating foresters. At the end of each season a detailed report of survey findings is prepared and distributed to all interested parties. The first surveys, in 1947, revealed 907,000 acres of spruce budworm epidemic infestations in the two states. In 1948, infestations were recorded on 1, 446, 000 acres, with sizeable outbreaks occurring for the first time in the extensive, high-value Douglas-fir forests of western Oregon. At the peak of the epidemic in 1949, some 2,276,000 acres were heavily infested, and the budworm was present in some degree in practically all fir stands of the two states.*[139]

Control work for forest insects and diseases in the Forest Service was consolidated at the **national** level in Washington, DC into a new division of Forest Pest Control.

> **Forest Service Pest Control Work Consolidated:** *All control work on forest insects and diseases has been consolidated into one division of the Forest Service, the U.S. Department of Agriculture announces. This new division of Forest Pest Control will be responsible for activities in controlling insect infestations, disease epidemics, and white pine blister rust control on federal, state, and privately owned forest lands. Warren V. Benedict, formerly in charge of the white pine blister rust control program, will head the new division. Since most of the work will be done cooperatively with state foresters and other public agencies or private landowners, the division will be under the general supervision of William S. Swingler, assistant chief of the Forest Service in charge of cooperative programs. Assisting Mr. Benedict will be Conrad P. Wessela, formerly in charge of blister rust control work in the Pacific Northwest Region of the Forest Service, and Russell K. Smith, former supervisor of the Nebraska National Forest at Lincoln, Neb.*[140]

1957:

Figure 85. *OSBF plane with pilot A.T. Larsen and Walter J. Buckhorn. Springfield, OR. August 1957. Photo courtesy of Peter Orr.*

[139] Whiteside, J.M. 1956. Spruce budworm control in Oregon and Washington 1949-1956. Portland, OR: UDDA, FS, PNFRES, Division of Forest Insect Research. p. 4-5.

[140] Journal of Forestry. 1956. Forestry news. 54(10):734.

Paul Buffam (Figure 94) was first hired in 1957 as a seasonal employee to assist Russ Mitchell on research projects. At this time the survey and control group was led by John (Jack) Whiteside (Figure 83). Others involved with surveys that year were Walter Buckhorn, Peter Orr (Figure 86), and Bill Klein. In 1977 Paul Buffam came back to the region as the Director of Forest Pest Management.[141]

From *Forest Insect Conditions in the Pacific Northwest during 1957*:

> **Preface**
>
> ...
>
> *Results of the 1957 survey are presented in this report. Because of their importance in forest management and general similarity to insect-caused damage and mortality, the damage caused by bears and losses of western hemlock from unknown causes are discussed under the heading 'Other Pest Problems in 1957.' Brief mention of porcupine damage is also made in this section.*
>
> *Insect conditions were evaluated from four primary sources of information: 1) regional aerial detection and appraisal surveys, 2) ground surveys, 3) ground observations by foresters and entomologists, and 4) insect materials submitted to the Station by private and public landowners and land managers.*
>
> ...
>
> **Aerial Surveys**
>
> *A total of 335.2 hours of flying time during the period June 24-September 30 and four combinations of survey personnel were required to complete the regional surveys in 1957. Practically all the flying was completed by September 10; however one trip on September 30 was necessary to evaluate small areas of spruce budworm infestations in the Blue Mountains of Oregon.*
>
> *These surveys were again coordinated and conducted under the leadership of W.J. Buckhorn, assisted by P.W. Orr. C.B. Williams, Jr., was employed for training as an aerial observer and was indoctrinated in both aerial- and ground-survey methods.*
>
> *The Oregon State Board of Forestry provided the services of Pilot A.T. Larsen and the State Cessna 170-B for 70 hours of flying time in Oregon. In order to complete the Oregon survey, the Station contracted with the State for the use of the plane and services of the pilot for an additional 64.18 hours of flying time.*
>
> *The Washington Department of Natural Resources again provided the services of K. Turnball as aerial observer during surveys in that State. He was given additional training by Buckhorn.*
>
> *As in past years, Weyerhaeuser Timber Company provided its Cessna 170-B and the services of P.G. Lauterbach and C.R. Dunbar for 70 hours of survey time. The Company's branch forests were surveyed during this time and the findings turned over to the Station for inclusion in the regional summary. Additional hours were flown to detect any large areas of windthrown timber on company holdings.*
>
> *The Station used the services of two other agencies to complete the regional survey. Skyways, Inc. was low bidder on a request for the services of a Cessna 180 and pilot. A nearly new plane and Pilot R. Alexander were used for a total of 125.25 hours of survey time. The Region 6 fire control Cessna 180 and Pilot M.K. Pierce were used for 5.30 hours at the end of the season to check spruce budworm infestations.*
>
> *Balsam woolly aphid infestations again received special attention in 1957. Centers of epidemic infestation were mapped in the usual manner during a special appraisal survey late in the year. In addition, a combination photographic and ground survey plan was developed and carried out for evaluating aphid damage on a special cooperative survey in the Mount St. Helens area.*
>
> *A special survey was made to appraise black-headed budworm damage and to detect areas of hemlock looper activity.*[142]

[141]Personal communication with Paul Buffam, 10/27/2015.

[142]Whiteside, J.M. 1958. Forest insect conditions in the Pacific Northwest during 1957. Portland, OR: PNFRES, Division of Forest Insect Research. 54 p.

From the PNFRES *Annual Report 1957*:

Aerial Survey Techniques

The aerial survey techniques research project is sponsored by the Station's Forest Economics and Forest Insect Research divisions, and the Timber Management division of the [R6] Regional Office.
...
During the spring of 1957, the aerial-survey techniques project made substantial additions and improvements in its equipment. Acquisition of a new airplane, a Cessna 180, should greatly increase efficiency in making aerial techniques studies. Cruising speed, rate of climb, and service ceiling of the new plane are greater than those of the one formerly used.[143]

ODF:

Legislature approved a two man insect and disease staff in the Services Division. Al Larsen became Insect and Disease Director with Insect and Disease field assistant, Ernie Pearson (on board January 1, 1958). Al Larsen's Forester-pilot position became vacant.[144]

ODF Insect and Disease Control Section:

In order that timber owners may currently have knowledge of the pest situation on their forest lands, an aerial survey is conducted each year by the state in cooperation with the Pacific Northwest Forest and Range Experiment Station. All areas of infestation from insects and disease are mapped by size, type, and intensity. Reports and maps are made available to all interested landowners. The state contributes 70 hours of airplane time, furnishes the plane on a cost basis for another 50-60 hours of the aerial survey, and contributes the pilot's time [Al Larsen] for this entire period. When the personnel are available, the state also assists in the ground checking of insect and disease infestations.[145]

Figure 86. *Peter Orr, R. Pope, and Ken Wright. 1952. USFS R6 Aerial Survey Program Collection.*

[143]PNFRES. 1958. Annual report 1957. Portland, OR. p 66.

[144]ODF. 2014. A chronology of Oregon's forest insect and disease program with highlights of historical events and emphasis on the Oregon Department of Forestry. Unpublished report compiled by: LeRoy N. Kline; Eugene A. Irwin; Dave Overhulser; et al. Hardcopy, R6 aerial survey program files. Sandy, OR.

[145]ODF. 1957. Insect and disease section report. Hardcopy, R6 aerial survey program files. Sandy, OR.

1958:

Figure 87. *Board Room, West Coast Lumberman's Association. Northwest Forest Pest Action Committee. Harold Weaver, Travis Tyrell, Hardin Glascock, Donald, Hopkins, William Looney, Ernest Kolbe, Robert Furniss, Al Larsen, (unidentified), Benton Howard. April 1, 1958. Photo by Wally C. Guy. USFS Portland Station Collection, PS-1765.*

Figure 88. *Technical director John M. Whiteside (left) and project director Benton Howard (right) examining budworm spray progress map. John Day airstrip. 1958. Photo by Peter W. Orr. USFS Portland Station Collection, PS-1817.* [146]

[146]Whiteside worked for Forest Service Research at this point; his group conducted the surveys and provided technical guidance on control projects. Benton Howard worked for Forest Service Division of Timber Management, in charge of control projects in the region. In July 1961 these two groups were merged under the leadership of Benton Howard.

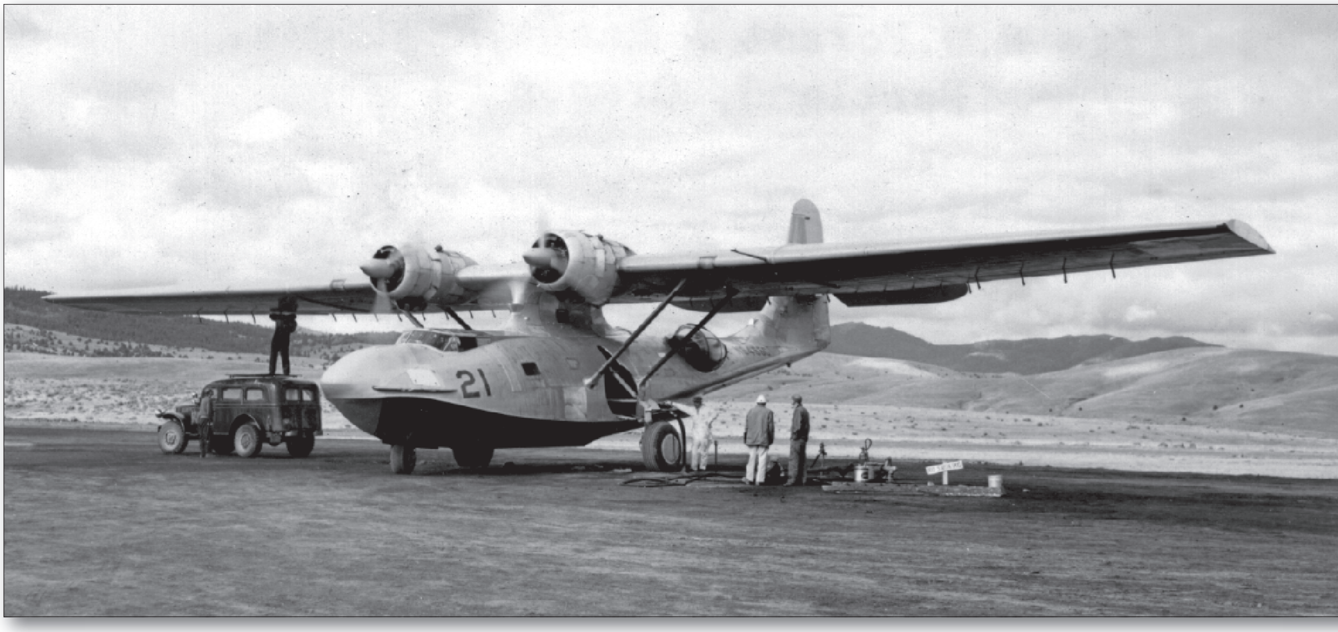


Figure 89. *PBY (PB=Patrol Bomber; Y=manufactured by Consolidated Aircraft) spray plane. John Day airstrip. June 1958. USFS Portland Station Collection, PS-1847.*

Figure 90. *Douglas DC-3 spray plane. Baker, Oregon. June 1958. USFS Portland Station Collection, PS-1849.*

Most of the early aerial surveyors were also involved with control operations. The surveyors, and many other staff and temporary personnel, participated in a variety of field and support activities which took place before, during, and after the suppression projects (Figures 91a, b, c, and d).

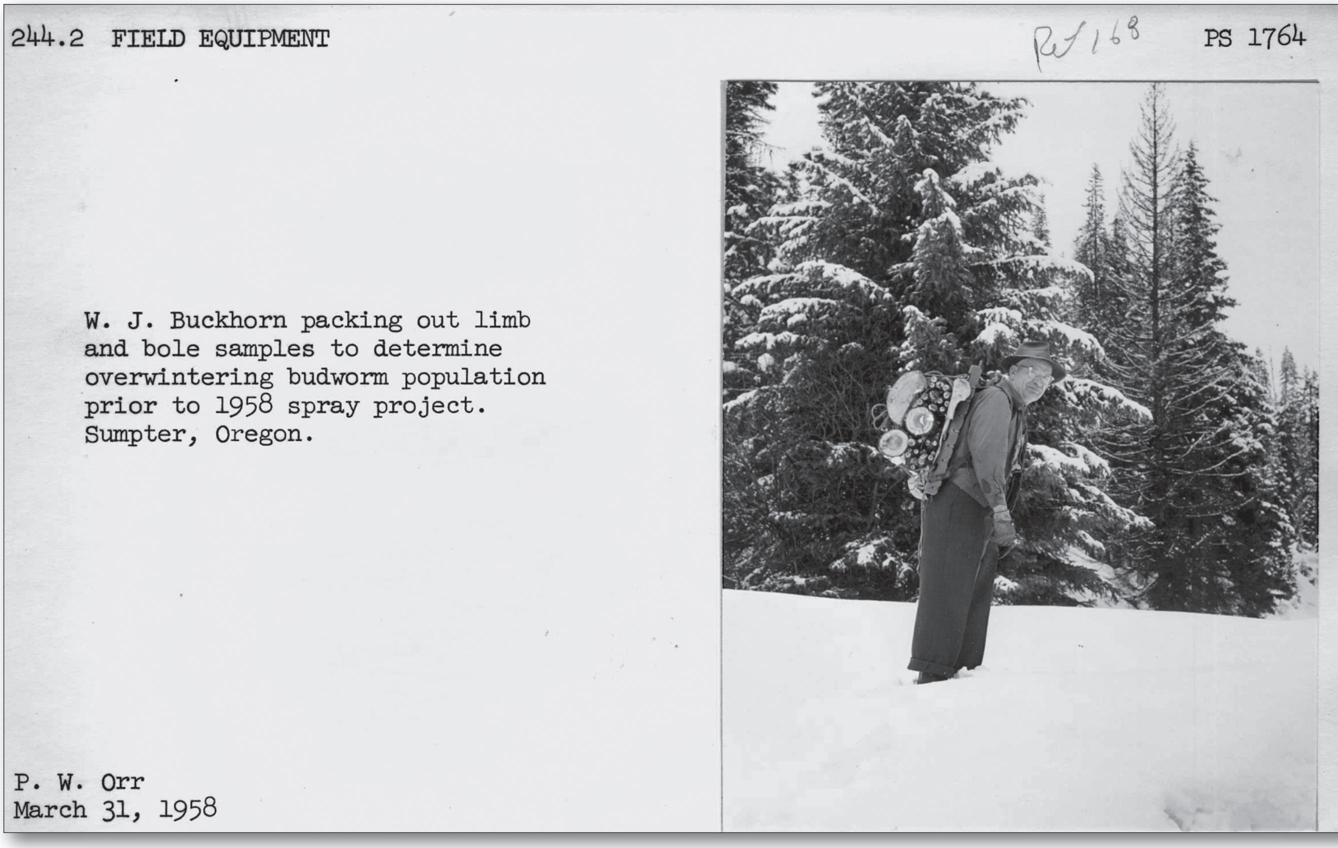


Figure 91a. *W.J. Buckhorn packing out limb and bole samples to determine overwintering budworm population prior to 1958 spray project. March 31, 1958. Sumpter, Oregon. Photo by Peter W. Orr. USFS Portland Station Collection, PS-1764.*

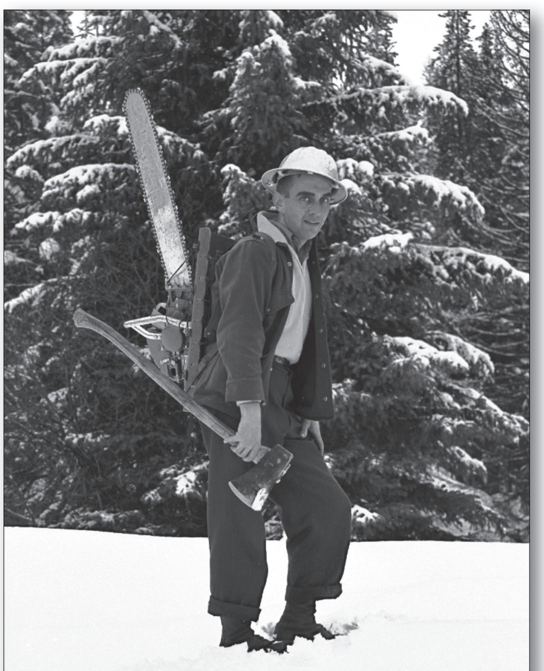


Figure 91b (left). *Peter W. Orr with equipment used to collect limb and bole samples in hibernating budworm survey prior to 1958 spray project. March 31, 1958. Sumpter, Oregon. Photo by W.J. Buckhorn. USFS Portland Station Collection, PS-1763.*
Figure 91c (right). *Peter W. Orr counting spruce budworm larvae that have broken hibernation. These cages at Sellwood (see Appendix 6) were used to force spruce budworm larvae to break hibernation prior to the 1958 spray project. April 4, 1958. Photo by W.C. Guy. USFS Portland Station Collection, PS-1762.*

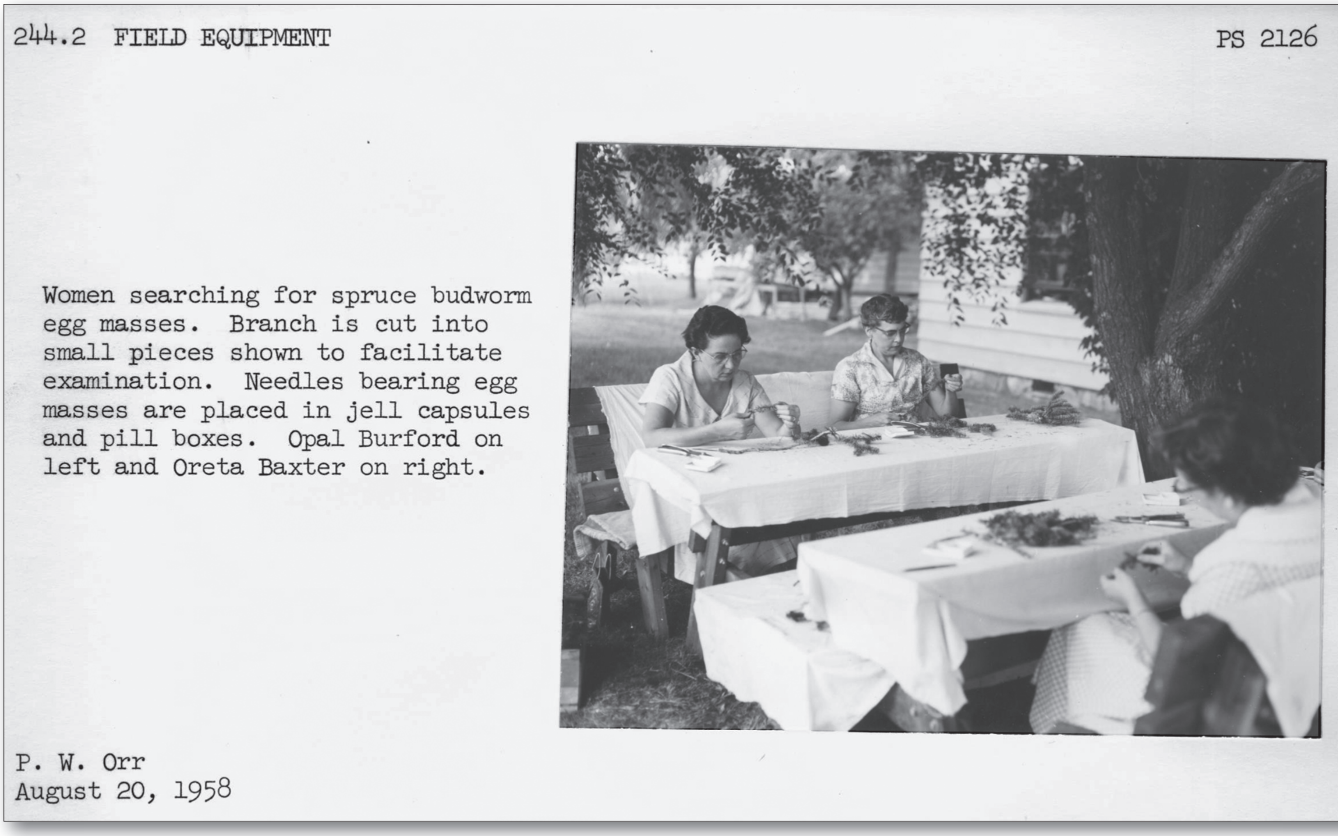


Figure 91d. *Opal Burford (left) and Oreta Baxter (right) searching for spruce budworm egg masses. Branch is cut into small pieces shown to facilitate examination. Needles bearing egg masses are placed in jell capsules and pill boxes. Union Ranger Station, Union, Oregon. August 20, 1958. Photo by Peter W. Orr. USFS Portland Station Collection, PS-2126.*

Figure 92. "Leon Pettinger flew his first year in this Cessna 182 Skylane in 1958. Leon held a pilot's license, which made him a good back-up pilot in the unlikely event of an emergency." *(Source: Keith Sprengel's 50 Years of Aerial Survey presentation.) Photo by Peter Orr. USFS R6 Aerial Survey Program Collection.*

From *Forest Insect Conditions in the Pacific Northwest during 1958*:

As in recent years, the regional aerial survey was a joint effort by four organizations: Oregon State Board of Forestry, Washington State Department of Natural Resources, Weyerhaeuser Timber Company, and the Pacific Northwest Forest and Range Experiment Station. . . . The bulk of the flying was done between July 7 and August 7, with some flights later in the season to detect balsam woolly aphid infestations in subalpine fir.

Flying in Washington was done in a plane contracted for by the Experiment Station. P.W. Orr, Experiment Station, and Kenneth Turnbull, Washington State Department of Natural Resources, acted as observers. Weyerhaeuser Timber Co. lands were surveyed by P.G. Lauterbach, observer and R. Chapman, pilot, in a company plane.

In Oregon, the State Board of Forestry provided the services of A.T. Larsen, pilot and 60 hours of flying time in a State-owned plane. The Experiment Station contracted with the State for use of the plane and pilot for an additional 50 hours of flying time to complete the survey. W.J. Buckhorn and L.F. Pettinger were the observers in the State plane. Weyerhaeuser Timber Company lands in Oregon were surveyed by P.G. Lauterbach and R. Chapman.

In the two states, Weyerhaeuser Timber Company's total flying time amounted to about 50 hours. The Company survey was made according to previously agreed standards so it could be readily incorporated into the regional summary.

Ground Surveys

Aerial survey findings were ground checked by W.J. Buckhorn, P.W. Orr, L.F. Pettinger, R. Hunt and J. Grunwald of the Experiment Station to verify the identity of the insects and the degree of infestation, and to determine the population trend. Oregon State Board of Forestry provided the services of E. Pearson for ground checking in Oregon.[147]

1959:

Figure 93. *Summer assistants G. Fagerness (left) and Leon Pettinger (right) taking sample measurements on windthrown second-growth exposed Douglas-fir. McDonald Tree Farm, Washington. September 1959. Photo by Peter W. Orr. USFS Portland Station Collection, PS-2305.*

[147] Buckhorn, W.J.; Orr, P.W. 1959. Forest insect conditions in the Pacific Northwest during 1958. Portland, OR: PNFRES. p. 27-28.

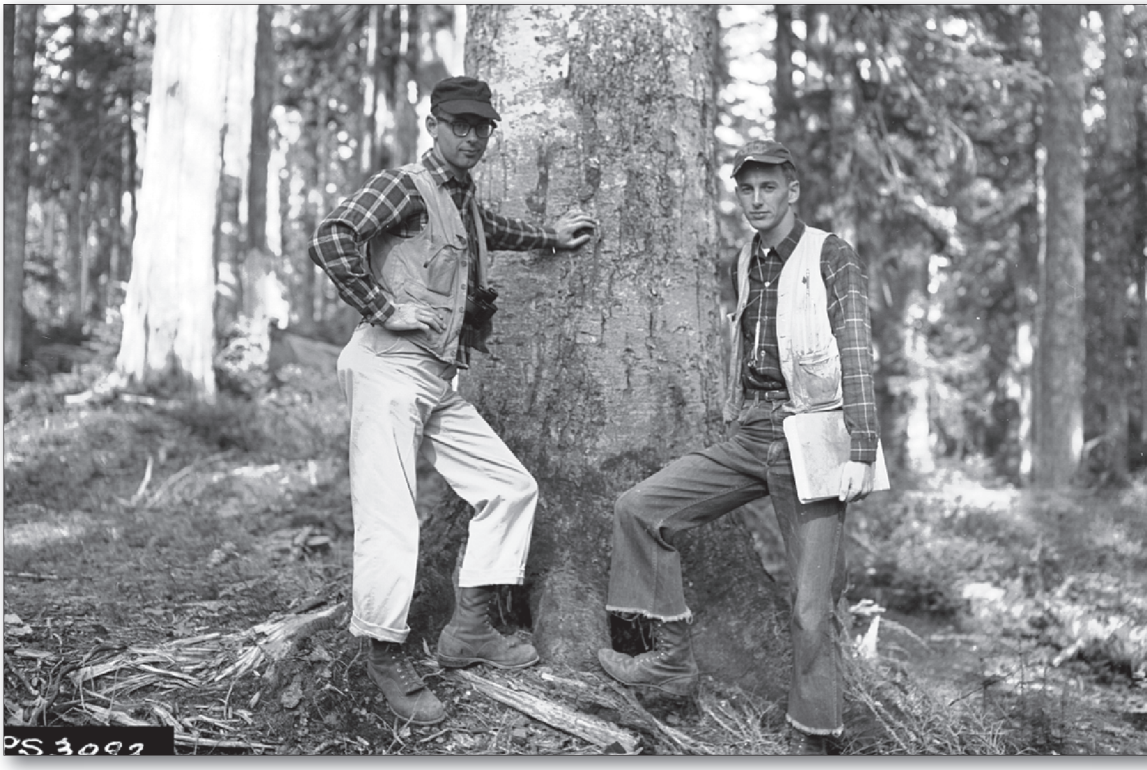


Figure 94. *Russ G. Mitchell and Paul E. Buffam on balsam woolly adelgid trend plot. Gifford Pinchot National Forest, Washington. September 1959. Photo by Ken Wright. USFS Portland Station Collection, PS-3092.*

Figures 94a and 94b. *Peter W. Orr removing the bark on a second-growth tree exposed to windfall prior to making a Douglas-fir beetle population count. Bark removed from second-growth exposed Douglas-fir windthrow to show the distribution of successful Douglas-fir beetle populations on the shaded portion of the log. McDonald Tree Farm, Washington. October 1959. Photos by Wally C. Guy. USFS Portland Station Collection, PS-2304 and PS-2316.*

From the June 17, 1959 *N.W. Forest News:*

[Forest Service] Rangers are heading into the field season determined to set new records in acres of timber stand improvement and new minimums in cost per acre. A select group of foresters are keeping us alert to pest damage as the result of having attended a 3-day pest control school conducted by Ben Howard and his assistants in Bend this spring. We can no longer live happily with our pests now that we know we have them.[148]

This was the first year that very few details regarding the conduct of the aerial survey were recorded. There was no mention of ground surveys associated with the aerial survey or any additional information about personnel.[149] This is the one small paragraph in the 1959 *Forest Insect Conditions Report*:

Organization and Conduct of Aerial Survey

As usual, the aerial phase of the regional survey was made cooperatively by four organizations: Oregon State Board of Forestry, Washington State Department of Natural Resources, Weyerhaeuser Co., and the Pacific Northwest Forest and Range Experiment Station. Most of the survey flights were made between July 6 and August 7; the remainder were made in September.[150]

From *The First Decade of the Pest Action Councils* (Kolbe 1959):

The Northwest Forest Pest Action Council … has no formal membership. Anyone interested in protecting the forest is invited to participate. The council is not a control agency. Instead, it is a catalyst. It consolidates thinking, planning and action. Before council organization, pest problems were handled pretty much on a localized individual basis. Each owner, each manager, each researcher went his own way until some crisis developed; then came a desperate scramble to improvise action. That is all changed now. The council with its broad representation of interest makes sure first that pest problems are fully examined and understood by all concerned. Projects of real merit survive such scrutiny, and control decisions are sure of powerful, unified support.

…

Listing of council accomplishments is most difficult because they are, to a large extent, intangible. Other hands do the actual work of detection, control, and research – but back of them all stands the council, coordinating, helping, pushing, seeing to it that all jobs needing to be done are done. Some major achievements…:

1. *The councils have aroused public interest in and support of forest pest control.*
2. *They have strengthened forest pest detection by stimulating volunteer observer service and by acting as a clearing house for survey findings.*
3. *They have done special survey and research jobs.*
4. *They have interested the chemical industry in pest control as a potential market for chemicals.*
5. *They have stimulated increased training in forest protection in the colleges; as a result there have been added curricula and special short courses.*
6. *They have stimulated research on a priority basis by reviewing needs and recommending action.*
7. *They have played the major role in getting control projects under way.*

…through the council organization, we have learned that detection surveys and economic studies are useful only when we know a control program will follow. It does little good … to use emergency funds to learn in detail about an insect or disease and then have no measure or procedure to stop the losses.

The first ten years … [have] been mainly devoted to getting important control jobs accomplished. From now on the councils will be looking into means of achieving greater efficiencies in all phases of detection, evaluation, control, as well as related research.[151]

[148]USFS. June 17, 1959. N.W. Forest News.

[149]During a February 13, 2007 conversation with John Wear, Keith Sprengel asked about the lack of survey metadata (aircraft types, personnel, etc.) in these later reports. John responded, *"Nobody cared about that stuff, they just wanted the damage information."*

[150]Buckhorn, W.J.; Orr, P.W. 1959. Forest insect conditions in the Pacific Northwest during 1959. Portland, OR: PNFRES. p. 23.

[151]Kolbe, E.L. 1959. The first decade of the pest action councils. Journal of Forestry. 57(4): 288-289.

1960:

220,0 PERSONNEL PS 2668

Executive committee; Northwest Forest Pest Action Council discuss the European pine shoot moth problem in Oregon and Washington. (L-R) Terrell, Furniss, Hopkins, Stark, Barnes, Bjorkland, Kolbe, Lauterbach, Rindt.

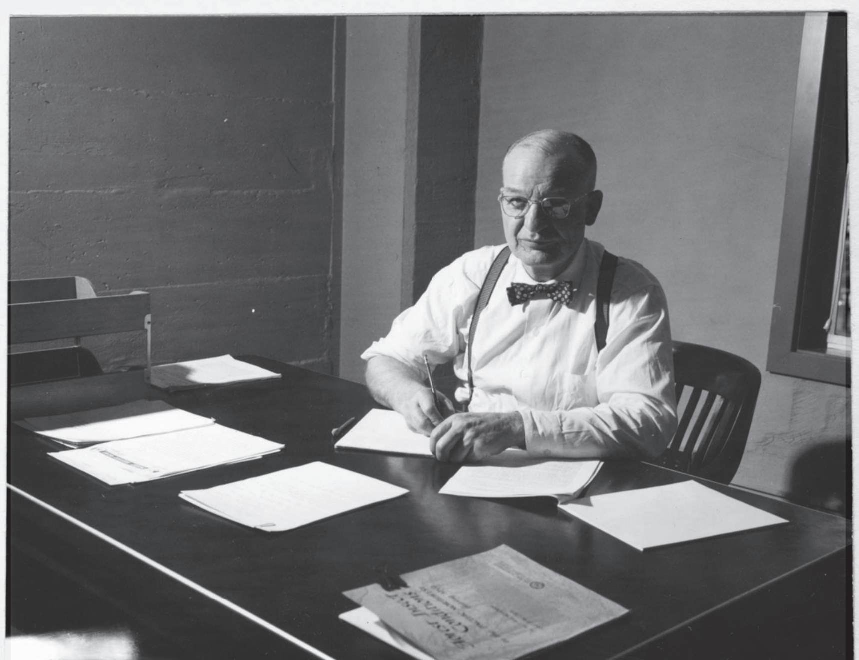
W. C. Guy
June 22, 1960

Figure 95. *Executive committee; Northwest Forest Pest Action Council discuss the European pine shoot moth problem in Oregon and Washington. Left-to-right: Terrell, Furniss, Hopkins, Stark, Barnes, Bjorkland, Kolbe, Lauterbach, Rindt. June 22, 1960. Photo by Wally C. Guy. USFS Portland Station Collection, PS-2668.*

220.0 Personnel PS 3232

W.J. Buckhorn
office

1960



W.C. Guy

Figure 96. *W.J. Buckhorn in the office. 1960. Photo by Wally C. Guy. USFS Portland Station Collection, PS-3232.*

1960 marked the end of the Pacific Northwest Forest and Range Experiment Station's responsibility for aerial survey program, as the aerial survey personnel were removed from Research and reassigned to the Division of Timber Management. From the PNFRES 1960 *Annual Report*:

> *A mixture of change and continuity characterized our forest insect research program in 1960. . . .*
>
> *Consolidation of pest detection, pest evaluation, and pest control activities, decided upon late in the year, marked 1960 as the last year of Station responsibility for insect surveys. All the activities will be carried out in the Pacific Northwest regional office of the Forest Service.*[152]

The other big change in 1960 marked an increase in survey-area; R6 gained responsibility for the counties in northeastern Washington, which had previously been surveyed by the Intermountain Forest and Range Experiment Station. From *Forest Insect Conditions in the Pacific Northwest during 1960*:

> **Organization and Conduct of the Aerial Survey**
>
> *This year the Station took over survey responsibility for the northeastern counties in Washington formerly serviced by the Intermountain Forest and Range Experiment Station at Ogden, Utah [Lincoln, Pend Oreille, Spokane, Whitman, and parts of Ferry and Stevens Counties].*
>
> *The aerial phase of the regional survey was made by Oregon State Board of Forestry, Washington State Department of Natural Resources, Weyerhaeuser Company, and the Pacific Northwest Forest and Range Experiment Station. Flying time this year totaled 199.1 hours. All survey flights were made between June 20 and July 27.*[153]

Again there were no details of who flew the survey, nor any mention of ground surveys. For the first time ever, the 1960 conditions report was published almost a year after the 1960 survey was completed (September 1961) – the delay undoubtedly due to the survey program's transfer to the Division of Timber Management.

As the aerial survey program left Research, this evaluation of the surveys and surveyors by the Research entomologists came out of the 1960 WFIWC meeting:

> **Damage Surveys:**
>
> *These surveys provide an indirect measure of insect populations of varying accuracy; with bark beetles they usually lag one generation behind the insect. Damage surveys still are basic to the detection survey program in the United States. Often they are heavily depended upon in deciding for or against control. They are useful in determining epidemic trends and cycles. They are especially useful in determining the economic need for control. The methods usually are empirical and heavily dependent upon the judgement and experience of survey personnel.*
>
> *Our feeling evidently is that damage surveys should be de-emphasized. I hope and believe they will not be eliminated. I urge, too, that the experienced observer not be underrated, for he still contributes much of value to the survey and research programs, even though his observations are not precise.*[154]

[152]PNFRES. 1961. Annual report 1960. Portland, OR. p. 40.

[153]Buckhorn, W.J.; Orr, P.W. 1961. Forest insect conditions in the Pacific Northwest during 1960. Portland, OR: PNFRES. p. 23.

[154]WFIWC proceedings. Ogden Utah, March 9-11, 1960. On criteria for control decision – R.L. Furniss. p. 28.

Chapter 6
The survey moves to National Forest Systems, Division of Timber Management – 1961-1974

Federal administrative survey responsibility: USDA Forest Service, Pacific Northwest Region, National Forest Systems branch, Division of Timber Management, Forest Insect and Disease Control

The survey and control staff were separated from Research and transferred to the R6 Regional Office. Benton Howard, hired in 1956 behind Alex Jaenicke in the Division of Timber Management, became their new supervisor. This merged group, formed on July 1, 1961, marked the beginning of the current-day Forest Health Protection staff.

From the introduction to the national *Forest Insect Conditions in the United States 1961*:

> *In 1961 there was a noteworthy change in assigned responsibilities within the Forest Service for planning, directing, and conducting forest insect and disease surveys. On July 1, responsibility for this work, previously assigned to Forest Insect and Disease Research Divisions of Forest Service Experiment Stations, was transferred to administrative divisions in the Forest Service Regions and at headquarters offices, Washington, DC. This transfer of survey responsibilities culminated extensive studies of means to intensify insect and disease surveys, facilitate the administration of suppression projects, and strengthen research on insect and disease problems.* ***As a result of this reassignment in responsibilities, entomologists and pathologists who had been handling survey work were transferred from Forest Service Experiment Stations to Forest Service Regional offices. At Forest Service regional headquarters in Juneau, AK; Portland, OR; San Francisco, CA; Ogden, UT; Denver, CO; and Albuquerque, NM, they were assigned to Divisions of Timber Management. At Missoula, MT; Milwaukee, WI; Upper Darby, PA; and Atlanta, GA, they were assigned to the Divisions of State and Private Forestry. Without exception, the pest control unit responsible for the consolidated survey and control program was centralized at regional headquarters.*** *In regions where travel distances were long and workloads heavy, provisions were made for some decentralization of personnel at zone offices. The latter pattern in organization was followed in the three Forest Service Regions east of the Mississippi River.*
> *J.W. Bongberg*
> *Chief Forest Insect and Disease Surveys*
> *State and Private Forestry*
> *USDA: Washington DC*[155]

From the regional *Forest Insect Conditions in the Pacific Northwest during 1961*:

> *On July 1, 1961 forest insect and disease survey and control responsibilities were transferred from the Pacific Northwest Forest and Range Experiment Station to the Division of Timber Management, U.S. Forest Service, Pacific Northwest Region.*[156]

[155]USFS. Forest insect conditions in the United States 1961. Washington, DC: State and Private Forestry. p. ii.

[156]Buckhorn, W.J.; Orr, P.W. March 1962. Forest insect conditions in the Pacific Northwest during 1961. Portland, OR: Insect and Disease Control Branch, Division of Timber Management, Pacific Northwest Region. Note on inside front cover.

Benton Howard retired in 1971, and David Graham replaced him as the Branch Chief, Insect and Disease Control in the Division of Timber Management.

For additional administrative details, see Appendix 2.

1961:

Figure 97. *Walter J. Buckhorn received the first annual Forest Protection award from W. Hagenstein of the Western Forestry and Conservation Association at the 52nd Conference. December 6, 1961. USFS Portland Station Collection, PS-3231.*

This article about Buck appeared in the USDA *News Bulletin*:

> ***Aerial Survey Pioneer***
>
> *Airplanes are used for many important jobs in the U.S. Department of Agriculture today. They are taken for granted for dusting large areas with insecticides or for aerial mapping and any number of other jobs. Forty years ago, however, their use was viewed with a great deal of skepticism.*
>
> *One of the many pioneers was Walter J. Buckhorn of the U.S. Forest Service. He had an idea. When he was first employed by the Department back in the 1920s on forest insect survey and control projects, he believed that airplanes could be used to obtain better and less costly surveys than the ground methods then in use.*
>
> *He emphasized that early suppression is the key to control of insect outbreaks. The aerial survey would help do this. He believed so strongly in his idea that he purchased an airplane and became a pilot and airplane mechanic to demonstrate its practicability.*
>
> *Loss of the airplane in a crash in which Mr. Buckhorn was not involved postponed the day of aerial surveys for 20 years. While it caused a long delay, it never caused this pioneer to lose faith in the use of the airplane for such surveys. He kept urging its adoption for insect surveys.*

> *Always a realist and team worker, Mr. Buckhorn did not hold back until his idea was adopted. He contributed much to the success of ground surveys which for many years provided the only available information on insect outbreaks in the forests of Oregon and Washington.*
>
> *Finally in 1947, this determined man developed and carried out the first comprehensive aerial survey of forest insect outbreaks in the West. Starting in an open-cockpit aircraft—reminiscent of the barnstorming days of the 1920s—he gradually perfected effective aerial survey methods. Since then he has been the principal aerial observer for the survey which annually covers the entire forested area of Oregon and Washington.*
>
> *Aerial mapping procedures developed by Mr. Buckhorn have been generally adopted by private, State, and Federal timber-managing agencies. But it took someone with an idea and persistence to accomplish it.*[157]

From *Forest Insect Conditions in the Pacific Northwest during 1961*:

> *This is the 14th annual report of forest insect conditions in Oregon and Washington based on cooperative surveys sponsored by the Northwest Forest Pest Action Council. The combined efforts of many organizations and individuals made these surveys possible. Special acknowledgement is made to the principal cooperators: Oregon State Board of Forestry and Washington Department of Natural Resources.*
>
> ...
>
> **Organization and Conduct of the Aerial Survey:**
> *The aerial phase of the regional survey was made cooperatively by three organizations: Oregon State Board of Forestry, Washington Department of Natural Resources, and the U.S. Forest Service. Flying time totaled 226.1 hours. Most of the survey flights were made between July 7 and August 18; the remainder were made in October.*[158]

ODF traded their Cessna 180 for Cessna 185:

> *The Department [ODF] is in the process of trading its present Cessna 180 for a Cessna 185. The Cessna 185 has a capability for carrying 6 people and it is anticipated that this plane will provide more utility both for general use, fire control work, and aerial photography….A large portion of the time of the plane is used in the annual aerial surveys covering the entire forested area of the state and on insect control projects.*[159]

The Oregon Insect and Disease Act was amended to authorize the state forester "*to make surveys and investigations to determine presence and extent of insect pests and tree diseases*."[160]

1962:

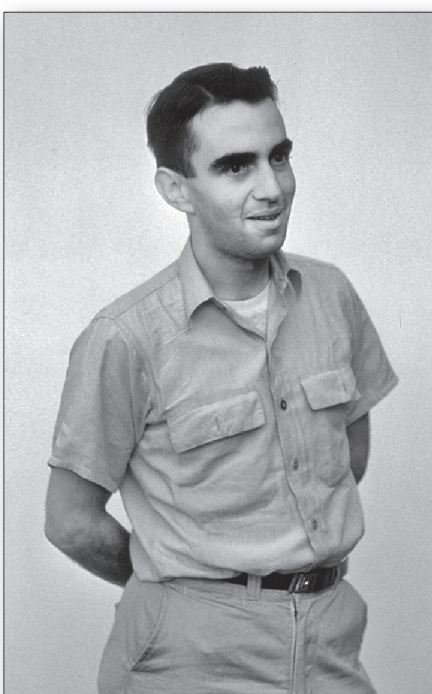


Figure 98. *When the aerial survey program was transferred to the Division of Timber Management in 1961, and with Whiteside's departure and Buckhorn's retirement, Peter Orr became the aerial survey veteran. USFS R6 Aerial Survey Program Collection.*

[157] USDA News Bulletin, March 28, 1962. Volume 21. Washington, DC: USDA, Office of Governmental and Public Affairs. p. 3.

[158] Buckhorn, W.J.; Orr, P.W. March 1962. Forest insect conditions in the Pacific Northwest during 1961. Portland, OR: Insect and Disease Control Branch, Division of Timber Management, Pacific Northwest Region. p. 25.

[159] From a 1961 ODF report: A résumé of the operation of the insect and disease control section and the plans for their future, Insect and Disease Control Section. Hardcopy, R6 Aerial Survey Program files, Sandy, OR.

[160] ODF. 2014. A chronology of Oregon's forest insect and disease program with highlights of historical events and emphasis on the Oregon Department of Forestry. Unpublished report compiled by: LeRoy N. Kline; Eugene A. Irwin; Dave Overhulser; et al. Hardcopy, R6 aerial survey program files. Sandy, OR.

March 2, 1962 – Walter J. Buckhorn published the 1961 conditions report in March of 1962 and then retired with 37 years of government service. While he and the survey program had been administratively assigned to the Division of Timber Management on July 1, 1961, Buck's retirement in March took place before the survey program's physical move to the Regional Office down the street. That move happened later in 1962, after Buck retired.[161]

Excerpts from a letter that John Wear wrote to Buck and his wife Bertha for Buck's retirement:

> *February 1962*
> *Dear Buck and Bertha,*
>
> *How's the flying weather today? The weather boys say it's fine on the southern Oregon coast but lousy on the Olympics. Clear skies in Portland and chances for two more days of the same. I'm sure you will recall the thousand and one times we cross checked the weather in Oregon and Washington in the hopes of finishing off some more of the regionwide surveys. …*
>
> *To start at the beginning would be to recall our many adventures with the N3N back in 1947. The old 'yellow peril' arrived from Orlando, Florida sadly in need of maintenance. One gallon of oil used /per hour was slightly excessive, don't you think? Not too many 'horses' either and I'm sure you will remember some of the rather narrow squeaks we had. Downdrafts were just too much for Betsy and only the presence of a convenient canyon off the Imnaha in Eastern Oregon kept us from harvesting some ponderosa pine along the ridge. We must have flown nearly 15 miles down the canyon to get enough altitude to climb back on top of the next ridge to continue our survey. Your familiarity with all that country … was a terrific help in keeping oriented. Trying to talk back and forth over the engine roar, our heads out in the slip stream, and the wind whistling through our goggles was a shouting proposition in every aspect. The old gosport or 'speaking tube' communication system left a lot to be desired. But we got a lot of area surveyed and you taught me a lot about the appearance of 'bug damage' from the air.*

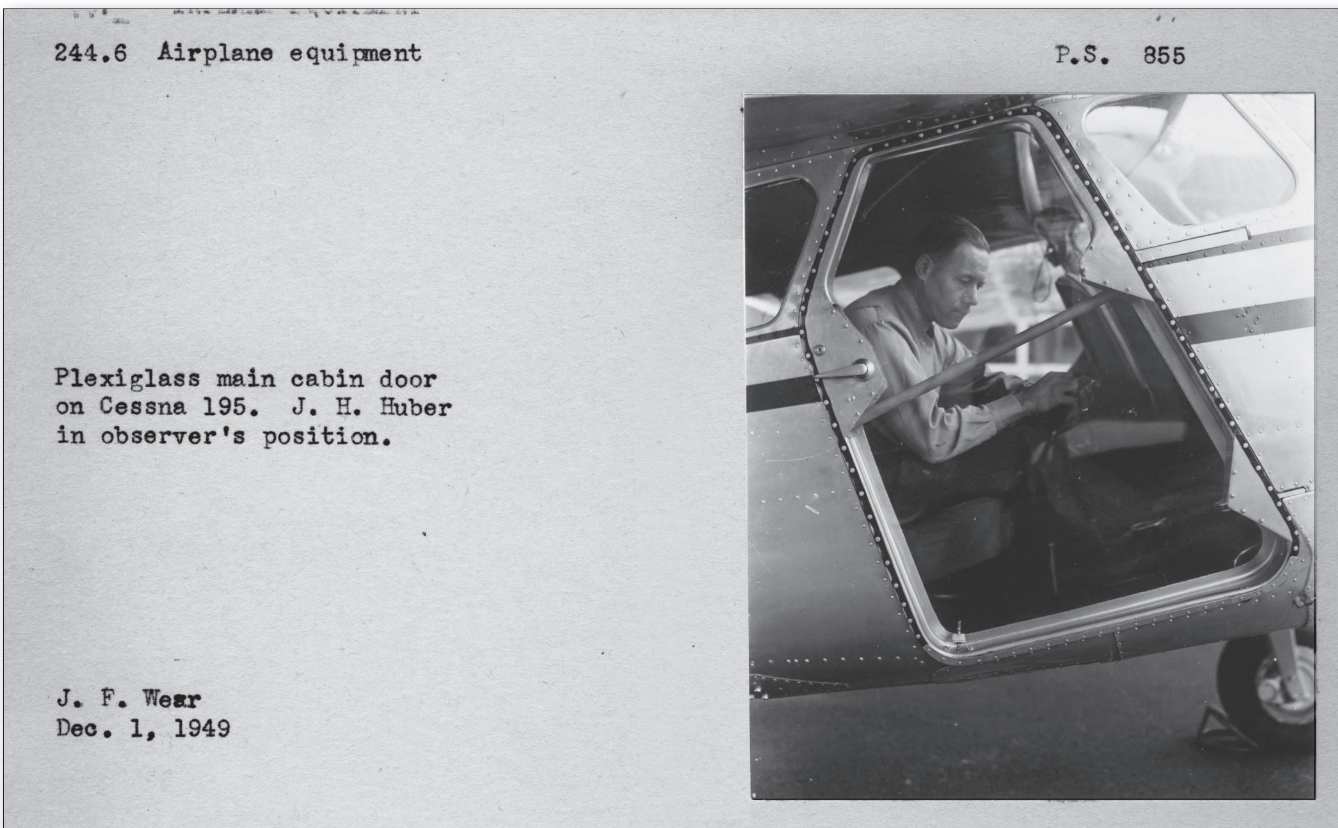


Figure 99. *Plexiglass main cabin door on Cessna 195. J.H. Huber in observer's position. December 1, 1949. Photo by John. F. Wear. USFS Portland Station Collection, PS-855.*

[161]Personal communication with Peter Orr, November 12, 2015.

The old John Day strip next to town was always a thrill. The heavy coarse gravel 'tailings' from the gold mining operations that had been bulldozed off for the strip never seemed to be quite long enough. What a rough strip and with the engine dead the N3N was a real struggle to move for gassing or tie-down. The only nice feature of the strip was the close proximity to town and eating facilities. Of course the other strip on the bluff above town was better but gas had to be hauled up the mountain and it was a long walk for food. . . .

Then we graduated from the N3N to Luscombe and Cessna 170 rentals and finally wound up with the Cessna 195. We improved the visibility by putting together a plastic door [Figure 99], and generally had a good working tool until getting caught in the cross wind at Bellingham. That took care of the landing gear on the right side and ended up as a trade-in for probably the best. The Cessna 170 was a fine work horse. Visibility was hard to beat and upon occasion we did need more power. One time we needed a little more gas but we made new friends at Hartstene Island north of Olympia on our way to cover the north side of the Olympics which was always a difficult area to complete. That area of southwest Washington along the coast has always been a stinker too! The time we were flying westward along the ridgetops out of Olympic peaks was a real rough show too. You and I bounced our heads on the ceiling a good many times that day! Such is life on the aerial surveys.

The various times we were on surveys away from Portland brings to mind your very early rising habits and how you used to rouse us out at an early hour to get breakfast and plan to get airborne by 7. It was quite a shock at first to be checking out shortly after sunrise but we always got used to it. On those cold nights [sleeping outside, under the wings of the aircraft] I'll not forget your woolly nightcap to keep your head warm! A person really appreciates some of the comforts when 'roughing it'!
. . .
You have reached a wonderful period in which to do some of the things you have always planned or wanted to do. Take life easy, stay active, and we'll be seeing you do many of the things we would like to do if we had time. Best of everything to you two.
Sincerely,
John Wear[162]

Entomologist Robert E. Dolph transferred to the R6 Regional Office staff from R4 (Ogden, UT) in 1962.[163]

Sept. 27, 1962 - *Silent Spring* was published.

[Silent Spring] … electrified a slowly growing, science-dominated environmental movement.... [Carson's] attack on misuse or overuse of pesticides brought swift response from the highest levels of government. A presidential panel on pesticides saw its recommendation for more stringent safeguards implemented over strenuous protests of public agencies including the Forest Service. Foresters generally believed that only by extensively applying DDT would they be able to keep certain forest pests in check. The very qualities of the agent that made it potentially harmful were the same qualities that made it the most effective insecticide around.[164]

From *Forest Insect Conditions in the United States 1962*:

Growing concern by the American public over the use of pesticides for controlling insects and diseases in the United States prompted joint action by the Secretaries of Agriculture, Interior, Defense, and Health, Education and Welfare to provide for thorough review of control plans by all Federal agencies using pesticide chemicals. Accordingly, a Federal Pest Control Review Board, with representative membership by all interested Federal agencies, was established late in 1961. This Board carefully screened and cleared the 1962 control plans of the Forest Service and its cooperators after determining that hazards to water, recreation, food and feed crops, as well as to fish and game, were adequately safeguarded.
J.W. Bongberg
Chief; Forest Insect and Disease Surveys
State and Private Forestry [165]

[162]Letter courtesy M.M. Furniss and the WFIWC archives.

[163]Personal communication with Paul Buffam, May 21, 2016.

[164]Steen, H.K. 1976. *The U S. Forest Service, a History.* Seattle: University of Washington Press. pp. 318-19, via Paananen, D.M.; Fowler, R.E.; Wilson, L.F. 1987. The aerial war against eastern region forest insects 1921-86. Journal of Forest History. October:173-186.

[165]USFS. 1963. Forest insect conditions in the United States 1962. Washington, DC: State and Private Forestry. p. ii.

Figure 100. *Blowdown from Columbus Day Storm. Photo taken October 25, 1962. Hebo District, Siuslaw National Forest. Photo by Wally C. Guy. USFS Portland Station Collection, PS-2747.*

Figure 101. *Blowdown from Columbus Day Storm Oct. 12, 1962. Photo taken October 25, 1962. Cascade Head Experimental Forest, Otis, Oregon. Photo by Wally C. Guy. USFS Portland Station Collection, PS-2741.*

October 12, 1962 – the Columbus Day Storm. NFPAC's response to the Columbus Day Storm:

Action Taken By Northwest Forest Pest Action Council Annual Meeting at Portland, Oregon, October 19, 1962
Timber Disaster Committee

1. *It was resolved that a general cooperative survey should be made over approximately 20 million acres. The survey should delineate boundaries and classify damage by intensities. It is recommended that high level photography be used and coordinated compilation of data collected from landowners by Timber Disaster Committee.*

2. *Recommend that Pest Action Council urge all forest owners immediately to look at their lands and start salvage immediately to capture damage values, reduce the bark beetle potential, and lower fire hazard. The Council commends all landowners who have already started to salvage their losses and encourages them to continue.*[166]

US Forest Service, Pacific Northwest Region news release, November 7, 1962:

Air Survey Completes Timber Blowdown Picture

An aerial survey of blowdown timber left in the wake of the Columbus Day storm will be completed this weekend, weather permitting, according to J. Herbert Stone, Regional Forester, U.S. Forest Service, Portland.

The cooperative survey will cover approximately 8 million acres of timberlands in western Washington and southern Oregon not already surveyed for blowdown. Lands involved are state, private, and federal (primarily National Forest and Bureau of Land Management).

The Forest Service, at the request of the Timber Disaster Committee of the Northwest Forest Pest Action Council, is coordinating all survey information and making the supplemental aerial surveys as needed to give coverage of an area totaling 22.5 million acres. The aerial project will fill the gaps in information already furnished by the state foresters of Oregon and Washington, private industry, National Forests, and Bureau of land Management districts affected by the storm.

Completed surveys will show the estimated volume of timber blowdown and will provide a general map of the windfall damage by light, moderate, and heavy classifications. The aerial survey involves sketch mapping of blowdown areas. Survey data will help point out problem areas and determine salvage goals, Stone said. Quick salvage is important to prevent outbreaks of insects, primarily the Douglas-fir beetle. It is also important to prevent loss through decay and to reduce the fire hazard. The data also will be used as guides in determining need for reinventories of timber stands, probable effect on allowable cuts, and so forth.

Eight aerial observers and four aircraft are involved in the supplemental survey. Five observers are from four western regions of the Forest Service, one from the Bureau of Land Management, and one each from the states of Oregon and Washington. The men have been flying every day that visibility would permit.[167]

From *Forest Insect Conditions in the Pacific Northwest during 1962*:

The aerial survey of the 52 million acres of timberlands in Oregon and Washington was a cooperative undertaking by the Oregon State Department of Forestry, Washington Department of Natural Resources, and the U.S. Forest Service. The survey was made between July 16 and August 17. Several later flights were made in the fall to detect western hemlock looper defoliation in western Oregon and Washington. A total of 241.4 hours of flying time were required to complete the survey.[168]

[166]Bjorklund, N.E. 1962. Report of the Northwest Forest Pest Action Council. In: Forest Pest Conditions in Western North America 1962. Portland, OR: Western Forestry and Conservation Association. p. 4-5.

[167]R6 aerial survey program files. Sandy, OR.

[168]USFS. Forest insect conditions in the Pacific Northwest during 1962. Portland, OR: Insect and Disease Control Branch, Division of Timber Management, Pacific Northwest Region. p. 29.

1963:

NFPAC news release on the Columbus Day Storm (no date; content indicates early 1963):

> "A year's supply of timber for the Oregon-Washington forest industry was blown down by the Columbus Day and subsequent storms," *said W.D. Hagenstein, Chairman, Timber Disaster Committee, in announcing results of a survey of more than 30 million acres subjected to high winds last fall.*
>
> *The survey was recommended by the Timber Disaster Committee, Northwest Forest Pest Action Council, immediately after the Columbus Day storm. It was conducted by the U.S. Forest Service in cooperation with BLM, the States of Oregon and Washington, and the forest industry, and found 11.2 billion feet of timber blown down in the two States.*
>
> *The survey was financed by $23,000 of Federal Forest Pest Control Funds, with an additional $13,000 from BLM, the States of Oregon and Washington, and the forest industry.*
>
> *An aerial survey using four airplanes and pilots, each with a team of two skilled observers, was organized by the Forest Service which brought in observers from Montana, Colorado, and Utah to work with local officials to fly and map the areas of windthrown timber. After the aerial survey, 67 plots were taken on the ground by cruisers to estimate the volume blown down.*
>
> *Hagenstein said that the TDC's latest estimate includes 6.6 billion feet of concentrated blowdown and 4.6 billion feet in scattered blowdown. This is more than double the blowdown reported to the President's Technical Conference in Portland and late October and results from more complete coverage of the storm area which revealed a 2 billion foot increase in concentrated blowdown and the first estimate of scattered blowdown.*
>
> *This make it more necessary than ever, the TDC Chairman said, to salvage the blowdown timber before the spring of 1964 to prevent wide scale tree killing by the bark beetles which will increase in population in the blowdown during the summer of 1963.*
>
> *Hagenstein commended all Federal and State forest agencies for modification of timber sale procedures to expedite the salvage and commented that the logging industry is giving its all in salvaging the timber from both public and private lands in the determined cooperative effort to beat the beetles and save the region's timber supply from further destructive loss.*[169]

From *Forest Insect Conditions in the United States, 1963*:

> *In 1963, the American public indicated through local and national communications media its grave concern over the use of pesticide chemicals for the control of insects. Reaction came from many sources, paramount among them the report on pesticide chemicals by the late President John. F. Kennedy's Science Advisory Committee. With potential hazards of pesticides in mind, all projects for control of forest insects were carefully screened by Pest Action Councils and Committees at the regional level, and in turn by the USDA Pest Program Evaluation Group and the Federal Pest Control Review Board at the national level. This multiple screening of proposed suppression projects insured the elimination of undue pesticide hazards to water, recreation, food and feed crops, fish and game, and human beings, as well as to the birds and other wildlife that make the forests their home. The Forest Service warns users that all pesticides are poisonous, that the direction and precautions on the containers should be closely followed, and that overdosing should be avoided in forest spraying, especially over and around streams, ponds, and lakes.*
>
> *Also in 1963, significant progress was made in strengthening cooperative work among Federal and State governments and private agencies to protect resource values on non-Federal forest lands. Progress toward this end was accomplished by extending to States the cost-sharing provisions of the Federal Forest Pest Control Act that will help them in a continuing program of forest insect and disease detection and in evaluation surveys on non-Federal forest lands. This represents a significant step forward to reduce damage and loss caused by insects to the Nation's forests. As the States avail themselves of this opportunity to strengthen their work, survey and control activities will become intensified, and losses should be proportionately reduced.*
>
> *J.W. Bongberg, Chief*
> *Forest Insect and Disease Surveys*
> *Forest Service*
> *U.S. Department of Agriculture*
> *Washington, DC 20250*[170]

[169] R6 aerial survey program files. Sandy, OR.

[170] USFS. 1964. Forest insect conditions in the United States, 1963. Washington, DC: Forest Insect and Disease Surveys. Introduction.

From *Forest Insect Conditions in the Pacific Northwest during 1963*:

Introduction

Survey procedures were the same as those used in recent years. Epidemic outbreaks were detected and mapped from the air by standard methods. The intensity of ground surveys varied from time-consuming evaluation of spruce budworm and western hemlock looper egg populations to general verification of aerial mapping.

Organization and conduct of the aerial survey

The aerial survey of timberlands in Oregon and Washington was a cooperative undertaking by the Oregon State Department of Forestry, Washington State Department of Natural Resources, and the United States Forest Service. Region-wide detection survey flights were made between July 9 and August 29. Special detection flights were made in early June in northeastern Washington to detect and evaluate outbreaks of larch casebearer. In late October and early November other special flights were made in western Oregon and Washington to detect western hemlock looper defoliation.

This year personnel from State and Federal agencies accompanied the regular flight crew on detection flights over their respective administrative areas. This gave the managing forester a better understanding of his forest pest problems. Flying time required to complete all surveys totaled 317.3 hours.[171]

1964:

Figure 102. *ODF Cessna 185 used from 1962-1967. Photo courtesy ODF.*

[171]Orr, P.W.; Pettinger, L.F. 1964. Forest insect conditions in the Pacific Northwest during 1963. Portland, OR: Insect and Disease Control Branch, Division of Timber Management, Pacific Northwest Region. p. 4 and 40.

ODF established a new Forester-pilot position and Bob Franklin was hired.[172]

From Sprengel's *50 Years of Aerial Survey*:

> *Rick Johnsey started for the WDNR in 1964 and started survey work in 1965. Rick flew with Leon Pettinger … Aerial survey just happened to be part of the job he was hired for, and Rick flew through the 1970 season. Like many of the surveyors he flew in a wide variety of aircraft including what he called a P-38 and a very cold 170 with a photo port. Rick retired in 1992.*[173]

On October 6, 1964, J. Wear, R. Dolph, and P. Thiesen made an aerial survey for Douglas-fir beetle on the Siskiyou NF. Memo signed by Benton Howard.[174]

From the August 2, 1964 Eugene Register Guard:

> **Forest Insect Survey Started**
>
> *Two aerial crews have started the annual cooperative survey to detect epidemic outbreaks of forest insects in Oregon and Washington. The crews, each made up of a pilot and two observers, will fly a combined 250 hours this summer in covering 52 million acres of timberland under both private and public ownership. More than 25 destructive forest insect types are in two states and the survey will attempt to pinpoint those places where trees are being killed. In addition, some disease and animal damage may be recorded.*[175]

From *Forest Insect Conditions in the Pacific Northwest during 1964*:

> *This is the 17th annual report of forest insect conditions in Oregon and Washington. It is based on cooperative surveys sponsored by the Northwest Forest Pest Action Council. Many individuals and organizations made these surveys possible. Special acknowledgement is made to the principal cooperators: Oregon State Department of Forestry and Washington State Department of Natural Resources.*
>
> *On July 1, 1964, two U.S. Forest Service Zone Entomologists were moved to field stations, one in Seattle, Washington [Leon F. Pettinger] and one at Bend, Oregon [Robert E. Dolph]. These entomologists handle insect and disease survey and control problems in their respective states.*
>
> **Organization and conduct of Aerial Surveys**
>
> *Aerial surveys to detect outbreaks of important forest insects were a cooperative undertaking by the Oregon State Department of Forestry and U.S. Forest Service in Oregon, and between Washington State Department of Natural Resources and the Forest Service in Washington. Detection survey flights were made in early June to detect larch casebearer damage in northeastern Washington. Regular detection surveys were made between July 6 and September 15. Special evaluation surveys were flown in October. Flying time for surveys this year totaled 299.9 hours.*
>
> *Managing foresters accompanied the regular survey crews on the flights over their respective areas. This provided a good understanding of the size and intensity of the timber owner's forest pest problems.*[176]

[172]ODF. 2014. A chronology of Oregon's forest insect and disease program with highlights of historical events and emphasis on the Oregon Department of Forestry. Unpublished report compiled by: LeRoy N. Kline; Eugene A. Irwin; Dave Overhulser; et al. Hardcopy, R6 aerial survey program files. Sandy, OR.

[173]Sprengel, K.W. 1996. 50 years of aerial survey presentation. Portland, OR. R6 aerial survey program files. Sandy, OR.

[174]Dolph, R.E. memo dated October 29, 1964. Hardcopy, R6 aerial survey program files. Sandy, OR.

[175]Eugene Register Guard. August 2, 1964. Page 7D.

[176]Orr, P.W.; Pettinger, L.F.; Dolph, R.E. 1965. Forest insect conditions in the Pacific Northwest during 1964. Portland, OR: Insect and Disease Control Branch, Division of Timber Management, Pacific Northwest Region. Inside front cover and p. 50.

1965:

Figure 103. *Ercoupe – ODF. 1965. Photo courtesy ODF.*

Memo dated March 26, 1965, from Walter E. Lund, Timber Management to Forest Supervisor, Deschutes NF:

> *Subject – Insect and Disease Control*
> *Content: State forestry agencies have added, or will soon add, entomologists and pathologists to their staffs. As a result, the state foresters are assuming more responsibility for the administration and conduct of forest insect [ground] surveys. This points out the need for standardization of forest insect and disease survey techniques so that some of the surveys can be done by field personnel. We will hold a one-day workshop for insect and disease control survey people at our office at 9:00 am, April 27, to discuss uniform ground surveys and methods to assure quicker detection and better coverage of important forest insect outbreaks. The following are some points to be considered: 1) Need for ground detection surveys; 2) Insect species for which ground surveys are needed; 3) Objectives of these ground surveys; 4) Methodology to use for each insect; 5) Collection and analysis of ground survey data. As an outcome of this workshop, we hope that uniform ground detection survey methods can be developed for several important insects in OR and WA. Some of the methods will be tested in the field this season. Please let us know if R.E. Dolph will be able to attend the workshop to give his views on ground detection surveys.*
> *Signed, Benton Howard*[177]

Figure 103a. *LeRoy Kline (ODF). USFS R6 FHP Collection.*

Al Larsen (ODF pilot) hired LeRoy Kline as the state's forest entomologist in July of 1965 (Figure 103a). LeRoy worked for ODF from 1965 until he retired as the head of the Insect and Disease section in 1998. LeRoy was a strong advocate for the aerial survey program and flew surveys from 1965 until about 1984. He spoke at annual Board of Forestry meetings to provide updates on current forest insect and disease issues to ensure problems were brought to the forefront of discussions.[178]

[177] Hardcopy, R6 aerial survey program files. Sandy, OR.

[178] Personal communication with LeRoy Kline, March 14, 2016.

April 27, 1965, letter to Mr. R.E. Getty, State Director, BLM:

> *The annual aerial detection survey of forest insect damage in Oregon will begin on July 6. Would you care to have a district forester accompany our aerial survey crew when they make survey flights over BLM districts? Since weather conditions dictate the survey schedule, it is impossible to set exact dates at this time. Our proposed survey itinerary is as follows: July 6 – Medford area; July 12 – Coos Bay area; July 19 – Eugene and Roseburg. If it meets with your approval, Mr. R.E. Dolph, Oregon Zone entomologist will contact the district managers by telephone to arrange a time and place for meeting the plane.*
> *Sincerely Walter H. Lund, Assistant Regional Forester*
> *By: Benton Howard*
> *Cc: Peter Orr, R.E. Dolph*[179]

April 27, 1965, letter to Superintendent Crater Lake NP:

> *The annual aerial detection survey of forest insect damage will be made on Crater Lake National Park between July 6 and 9. Please let us know if you would like to have a forester accompany the survey crew when they make the survey. We will notify you a day or two in advance of the flight to arrange a time and place for meeting the plane.*
> *Signed: Walter H. Lund, Assistant Regional Forester*
> *By: Benton Howard*
> *Cc: P.W. Orr, R.E. Dolph*[180]

April 27, 1965, letter to R.D. Holtz, BIA, Portland, OR:

> *Dear Mr. Holtz,*
> *The annual aerial detection survey of forest insect damage will be made on the Warm Springs Indian Reservation the last half of July. Please let us know if you would like to have your timber staffman or his assistant accompany the survey crew when they make the survey. Since weather conditions dictate the survey schedule, it is impossible to set a date at this time. Mr. R.E. Dolph, Oregon Zone Entomologist, will contact the reservation by telephone to arrange a time and place for meeting the plane.*
> *Signed: Walter H. Lund, Assistant Regional Forester*
> *By: Benton Howard,*
> *Cc: A. W. Gailbraith, P.W. Orr, and R.E. Dolph*[181]

From *Forest Insect Conditions in the Pacific Northwest during 1965*:

> **Introduction**
>
> *Epidemic infestations were detected and mapped from the air. Ground surveys included intensive biological evaluations of the Douglas-fir tussock moth and spruce budworm and routine checking to verify the accuracy of aerial mapping. . . .*
>
> *The extent and trend of damage to trees caused by bears and the extent and trend of dying hemlock are discussed at the behest of the Northwest Forest Pest Action Council.*
>
> **Aerial Surveys**
>
> *Aerial surveys were coordinated by the U.S. Forest Service in cooperation with Oregon State Department of Forestry and Washington State Department of Natural Resources. Larch casebearer surveys in northeastern Washington were made in early June. Regular detection surveys were made between July and September. Douglas-fir beetle evaluation surveys were flown in September. Flying time for surveys this year totaled 321.1 hours.*
>
> *Managing foresters accompanied the regular survey crews on the flights over their respective areas to gain a better understanding of their forest pest problems.*[182]

[179] Hardcopy, R6 aerial survey program files. Sandy, OR.

[180] Ibid.

[181] Ibid.

[182] Orr, P.W.; Pettinger, L.F.; Dolph, R.E. 1966. Forest insect conditions in the Pacific Northwest during 1965. Portland, OR: Insect and Disease Control Branch, Division of Timber Management, Pacific Northwest Region. p. 4 and 48.

1966:

Figure 104. *Cessna 337 Skymaster. 1966. Photo courtesy ODF.*

Bob Dolph listed as "Oregon Zone Entomologist" Bend, OR in letters signed by Ben Howard (January 14 and June 7, 1966). But by the end of 1966, both Dolph and Pettinger had returned to work out of the RO in Portland.[183]

From *Forest Insect Conditions in the Pacific Northwest during 1966*:

Aerial Surveys

The general aerial detection surveys were made in July and August with fixed-wing aircraft. The surveys were coordinated by the U.S. Forest Service in cooperation with the Oregon State Department of Forestry and the Washington State Department of Natural Resources. Larch casebearer surveys in the northeastern Washington were made in early June also with a fixed-wing aircraft. Limited use was made of a helicopter to increase the accuracy of aerial mapping in preparation of logging plans to salvage mountain pine beetle mortality in lodgepole pine on the Fremont National Forest. Flying time for aerial surveys totaled 226.8 hours.

Ground surveys included detection surveys for larch casebearer, Douglas-fir tussock moth, western hemlock looper, and European pine shoot moth and biological evaluations of bark beetle outbreaks.[184]

[183]Hardcopy, R6 aerial survey program files. Sandy, OR.

[184]Dolph, R.E.; Pettinger, L.F. 1967. Forest insect conditions in the Pacific Northwest during 1966. Portland, OR: Insect and Disease Control Branch, Division of Timber Management, Pacific Northwest Region. p. 51-52.

1967:

In 1969, the aerial survey's data collection standards changed from recording relative intensities of damage to recording numbers of trees killed. Peter Orr's presentation to the 1967 Western Forest Pest Committee indicated a need for the change:

> **Surveys**
>
> *Since 1947, cooperative aerial and ground surveys have been made annually to detect damage caused by some 30 species of insects and several diseases. Today's detection and evaluation surveys provide the information needed to take prompt, coordinated control action. They are largely qualitative and don't provide quantitative data except in a general way. With few exceptions, they don't provide adequate information about the trend of insect populations or the intensification or spread of tree diseases.*
>
> *We're faced with increasing demands for much more detailed information about insect and disease outbreaks. The land manager needs detailed survey data so that he can, in turn, utilize the talents of the economist to determine whether or not control is economically justified. . . .*[185]

June 1, 1967, memo to FS supervisor on the Siskiyou NF:

> *Thanks for your report of Douglas-fir beetle activity on the Illinois Valley District, west of Highway 199. J.F. Wear will look at the area in question on his way north from a photo mission on the California Douglas-fir beetle outbreak this week. He'll contact Pete Thiesen about the problem and report what he has seen.*
> *Signed: H.G. Hopkins*[186]

February 14, 1967, letter to J.E. Schroeder, State Forester, PO Box 2289, Salem, OR 97310; attention A.T. Larsen:

> *Gentlemen:*
> *We appreciate receiving Mr. Kline's comments on the aerial photo interpretation short course given at Berkeley last December. Training sessions such as this are of value to all those working on insect and disease detection surveys and control operations. Revision of the Wear-Buckhorn manual on the* "Organization and Conduct of Aerial Forest Insect Surveys in Oregon and Washington" *has high priority in our spring work schedule. We hope to have it revised and ready for use by July. We will route the revised draft to you for review and suggestion.*
> *Signed C.G. Jorgensen, Assistant RF Timber Management*
> *cc J.F. Wear; P.W. Orr.*[187]

From *Forest Insect Conditions in the Pacific Northwest during 1967*:

> *Both States are divided into forest insect reporting areas as shown on the inside of back cover. These insect reporting areas are a simple convenience for reporting conditions in a geographical area. No attempt has been made to summarize insect outbreaks according to land ownership within an individual reporting area.*
>
> **Introduction**
> *Epidemic outbreaks of forest insects were detected and mapped according to intensity of damage from the air. Ground surveys were made to verify the aerial survey findings, detect sub-epidemic insect populations, and to evaluate threat and insect population trends.*
>
> *The problems of bear damage to forest trees and dying hemlock were recorded and discussed at the request of the Northwest Forest Pest Action Council.*

[185]Orr, P.W. 1967. Surveys. In: 1967 annual meeting of western forest pest committee. Portland, Oregon: Western Forestry and Conservation Association. p. 21-22

[186]Hardcopy, R6 aerial survey program files. Sandy, OR.

[187]Ibid.

Aerial surveys

The general aerial detection surveys were made in July and August. The surveys were coordinated by the U.S. Forest Service in cooperation with the Oregon State Department of Forestry and the Washington State Department of Natural Resources. Larch casebearer surveys in early June in northeastern Washington were coordinated with Region 1, U.S. Forest Service, Missoula, Montana. Flying time for all aerial surveys totaled 222.8 hours.[188]

1968:

Figure 105. *Robert E. Dolph (USFS) checking moth larvae. Burns, Oregon. June 1965. USFS R6 FHP Collection.*

From *Forest Pest Conditions in the Pacific Northwest during 1968*:

Introduction:

This report is a continuation of the series begun in 1947. Many of the statistical tables formerly included have been eliminated to make it more readable. More detailed statistical information on any particular pest is available upon request.

Epidemic outbreaks of forest insects were detected and mapped by aerial survey during June, July, and August. Ground surveys were made to verify the aerial survey findings, detect subepidemic insect populations, and evaluate the threat and determine insect population trends. These surveys were coordinated by the USFS in cooperation with the Oregon State Department of Forestry and Washington State Department of Natural Resources. Larch casebearer surveys in early June in northeastern Washington were coordinated with Region 1, USFS, Missoula, MT. Flying time for all aerial detection surveys totaled 223 hours.

Included in this report are tree losses attributed to causes other than insects, such as dying hemlock, bear damage to poles and saplings, and some diseases.

For ease in summarizing insect survey data, both States are divided into forest insect reporting areas as shown on the map in the inside back cover. These insect reporting areas are a simple convenience for reporting conditions in a geographical area. No attempt has been made to summarize insect outbreaks according to land ownership within an individual area.[189]

[188]Dolph, R.E.; Pettinger, L.F. 1968. Forest insect conditions in the Pacific Northwest during 1967. Portland, OR: Insect and Disease Control Branch, Division of Timber Management, Pacific Northwest Region. p. 4 and 54.

[189]Pettinger, L.F.; Dolph, R.E. 1969. Forest pest conditions in the Pacific Northwest during 1968. Portland, OR: Division of Timber Management, Insect and Disease Control Branch. Introduction.

1969:

National Environmental Policy Act (NEPA) of 1969 42 U.S.C. §4321 passed.

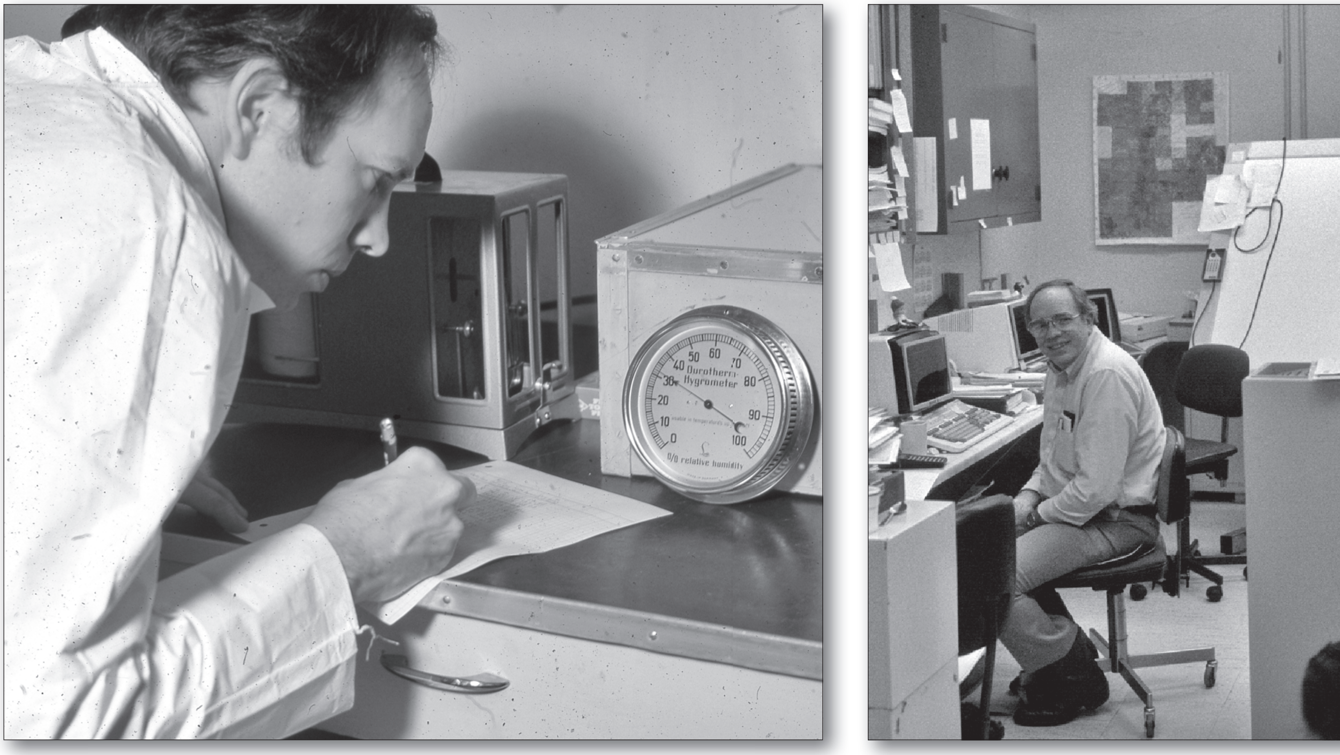


Figure 106 & 106a. *Tommy Gregg (USFS) was hired in 1969 as an aerial surveyor for Forest Insect and Disease Control in the Division of Timber Management. USFS R6 Aerial Survey Program Collection.*

From Sprengel's *50 Years of Aerial Survey*:

> *Tom Gregg [Figures 106 and 106a] got his degree in biology, and worked summers on the Tonasket RD of the Okanogan NF in timber mgmt. In 1957 Tom began to develop an interest in insects and diseases. Through this interest he got to know some of the folks in the RO entomology and pathology group. He had, at one time, asked Leon Pettinger about employment. In the mid-60s' during a MPB outbreak, Tom did a photo mosaic, and sketch mapped the outbreak from a helicopter while tagging along with the fire patrol. He used Leon's maps to locate areas of activity. [Tommy asked for special I&DC funding to help manage the outbreak. Dolph, Orr, Howard, and Pettinger all came out to review his work and were impressed with his survey skills.] In the summer of 1969, he was called in by the ranger, and asked if he would like to move to Portland. Ben Howard gave Tom the break by recognizing his interest in forest insects and diseases and skill at sketch mapping. Tom was trained by Bob Dolph and flew regularly until 1980 and again to help out in some personnel shortages in 1994 and 95.*[190]

Tommy's first flight as an aerial surveyor was on the 4*th* of July 1969 over the Siskiyou NF. He flew Oregon that summer with Bob Dolph and LeRoy Kline in a 337 Cessna FS rental and an ODF Cessna 210. Leon Pettinger flew Washington. Gregg remembers meeting David Bridgwater, at the time a student at the University of Washington, walking down the hall in Timber in 1969. 1969 was also the first year to report volume due to insect mortality and involved a major change in aerial survey data collection standards. Up to this time, relative intensities had been recorded, but in order to calculate volumes surveyors switched to recording numbers of dead trees, rather than intensity. Tommy said the minimum mapping standard they adopted was 5 dead trees, because that was a "Turn of logs" – a log truck load of salvage.[191]

[190] Sprengel, K.W. 1996. 50 years of aerial survey presentation. Portland, OR. R6 aerial survey program files. Sandy, OR.

[191] Personal communication with Tommy Gregg, September 25, 2015.

1969 was also David Bridgwater's first year as a summer temporary. He (DRB) spoke about the mountain pine beetle (MPB) outbreak during a 2006 oral history interview, conducted by Keith Sprengel (KWS) and Julie Johnson:

> *DRB: I started with the FS as a summer temporary in insect and disease control in the Regional Office in Portland in the June of 1969. I started full-time with the FS as a project forester on mountain pine beetle on the Wallowa-Whitman in June of 1971.*
>
> *…*
>
> *KWS: I was just going to ask you about your Wallowa-Whitman early career, western career – it was some time in the 70s and there was some big wave of mountain pine beetle-caused mortality.*
>
> *DRB: There was an outbreak that started in 1968 at Johnson Rock Lookout – started on the North side and eventually encompassed all of the south half of the Wallowa-Whitman, south half of the Umatilla, and the Malheur. Primarily in lodgepole pine but then also slipped into the Ponderosa pine, both the second growth and the older yellow bellies. My first job I was hired as a project forester on MPB – 460 Forester, but my primary job was to work with MPB. In those days we were doing service contracts to harvest lodgepole pine before the beetles got to it. I worked with surveying, where it was, how much and how fast it was being killed.*
>
> *…*
>
> *I spent nearly two years on Wallowa-Whitman and then transferred to the Delaware field office in the NE Area in 1972 as an entomologist. I spent four years there. In 1976 I moved out to the Regional Office in Portland, Oregon…*[192]

From an ODF Air Operations Report for June, 1969:

> *To: Don Maus, Assistant State Forester*
> *From: Al Larsen, Air Operations Director.*
>
> *…*
>
> *Aerial Insect Survey will be conducted with two planes this year which should release the Department Cessna much earlier than in previous years.*[193]

1969 marked a change in bark beetle mortality attributes. From the 1969 *Conditions Report*:

> **Introduction**
>
> *Forest pest infestations were detected and recorded by aerial and ground surveys in cooperation with the Washington State Department of Natural Resources and the Oregon State Department of Forestry. Ground surveys were made to verify aerial survey findings, detect low-level populations, and evaluate conditions and trends.*
>
> *This year bark beetle losses, except for Oregon pine ips, are expressed by volume rather than by intensity of damage. With the increasing demand for more intensive forest land management practices, volume estimates provide the information needed by the land owners and managers for the salvage and control of insect outbreaks.*
>
> *Oregon pine ips, defoliators, and sucking insects are reported by infested acreage and intensity of damage. No attempt was made to estimate the volume loss caused by these insects, which may well exceed the estimated loss attributed to the bark beetles.*
>
> *Timber losses due to dying hemlock, bears, storms, and some diseases are also reported here.*
>
> *The aerial survey for larch casebearer damage was not made this year, not because of lack of a problem, but because practically all larch stands in northeast Washington are now infested. Ground surveys were made, however, to determine extent of spread and to evaluate the damage.*[194]

[192]Sprengel, K.W.; Johnson, J.L. 2006. Oral history interview with David R. Bridgwater. August 18, 2006. Portland, OR. R6 aerial survey program files. Sandy, OR.

[193]Hardcopy, R6 aerial survey program files. Sandy, OR.

[194]Dolph, R.E.; Pettinger, L.F. 1969. Forest pest conditions in the Pacific Northwest 1969. Portland, OR: Division of Timber Management, Insect and Disease Control Branch. Introduction.

1970:

Figure 107. *Rick Johnsey (WDNR). Photo courtesy WDNR.*

November 23, 1970, memo to Benton Howard and Jack Mounts, from Peter W. Orr, Supervisory Entomologist regarding a mountain pine beetle service contract, which included: T.Gregg, P. Orr, B. Dolph, J. Mounts, and crews for field work.[195]

1971:

Figure 108. *ODF Cessna 206 used from 1968-1986. Photo courtesy ODF.*

[195]Hardcopy, R6 aerial survey program files. Sandy, OR.

With a background in white pine blister rust control and forest pathology, David Graham transferred from R5 to R6 in 1971 to replace Ben Howard after Howard's retirement. David's recollections of his time with the R6 staff:

> *Bob Dolph, an entomologist on my staff was in charge of aerial surveys, with Tom Gregg doing most of the flying with John Wear. John was part of my staff along with the plane … funded with Insect & Disease Control funds.*
>
> *Our agreements and cooperative relationships with the States did not change while I was in R-6. There were very little change in our operation, except for a large tussock moth control program in 1974.*
>
> *Our survey products were half inch/mile maps (sometimes larger scale depending on the situation) delivered to each National Forest, State Foresters, and Bureau of Indian Affairs.*
>
> *We were active participants with both Northwest Forest Pest Action Council and the Western Forestry and Conservation Association (WFCA). We kept them fully informed at all times of what we doing and the current insect and disease situations. Except for constantly improving our cooperative relationships there were no changes during my time in R-6. One year the WFCA presented me with a one-time special award for organization cooperative leadership. I personally attended nearly 100% of their meetings.*[196]

From Sprengel's *50 Years of Aerial Survey*:

> *A friend doing ground checking for aerial survey let Les Hoyle know of a job opening on the survey crew. Les was hired as a trainee in 1971, trained by Bob Dolph and Leon Pettinger and ended up flying until 1991. Les remembers a great training program developed by Tom Gregg in La Grande. The training lasted two days and consisted of classroom discussions, practice flights, and field trips to affected areas. It also allowed cooperators to exchange information and discuss techniques which helped to build consistency in the program.*[197]

In 1971 Peter Orr called Bill Ciesla in Region 1 to alert him to a Douglas-fir tussock moth outbreak in eastern Washington. Control of this outbreak became the source of much controversy over the next three years.[198]

From the 1971 national *Forest Insect and Disease Conditions in the US*:

> *Our Forest Insect Conditions Report has been issued annually since 1951 to provide up-to-date information on the scope, severity, and trends of the more important forest insect infestations in the United States. It has been fairly standard in format and scope of contents since 1960. This year, however, the report has been expanded to include forest diseases. We hope the addition of disease conditions will increase the usefulness of the report by keeping forest land managers abreast of both groups of pests on their lands and neighboring lands.*[199]

[196]Personal communication with David Graham, December 7 and 11, 2015.

[197]Sprengel, K.W. 1996. 50 years of aerial survey presentation. Portland, OR. R6 aerial survey program files. Sandy, OR.

[198]Personal communication with Bill Ciesla, May 6, 2016.

[199]USDA FS. 1972. Forest insect and disease conditions in the United States, 1971. Washington, DC: Division of Forest Pest Control. Introduction – page ii.

1972:

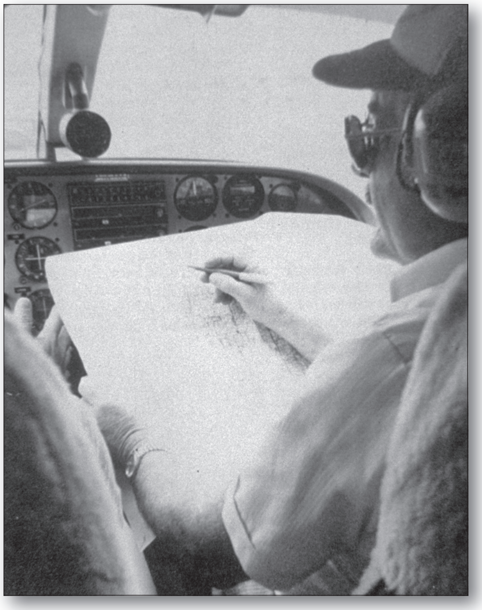


Figure 109. *Gene Irwin (ODF). Photo courtesy ODF.*

Figure 110. *Bob Backman (WDNR). Photo courtesy WDNR.*

Gene Irwin (Figure 109) was hired as a technician to assist the ODF forest pathologist in October 1972. From Sprengel's *50 years of Aerial Survey*:

> *Gene Irwin took flying lessons on the GI bill and worked on the Rogue River for insect and disease people in 1959. He got a job doing aerial survey with the state of Oregon in 1972 and flew for the next 20 years. He was trained the Tom "get in the back seat and don't miss anything" Gregg way.*[200]

Bob Backman (Figure 110) recalled his years with the survey:

> *I started flying aerial surveys in 1972 with Leon Pettinger, Rick Johnsey and pilot Phil Blair. The next season I was the WDNR observer and flew with Ken Vandermay. Ken was a school teacher the USFS hired for many summers. In 1974 I flew aerial survey with Don Curtis.*
>
> *In 1975 I was working with WSBW [western spruce budworm] in the Cascades from Ellensburg to the Methow. Was working with Bob Dolph, Jack Mounts, Red McComb, Leon Pettinger and others. I flew with Don Curtis in 1975 and we used a single engine USFS aircraft for part of the survey. Most of the survey was done with a 337 contract out of Troutdale.*
>
> *In 1976 WDNR started training a school teacher for aerial survey. Randy Reynolds worked for 2 seasons but his wife didn't like him being gone.*
>
> *In 1977 Rick Johnsey used Tim McConnell for the western spruce budworm projects of 1976 and 1977 and liked his work and started involving him in flying aerial survey. Tim flew with us in 1977 and 1978 and then went to work with the USFS. …*
>
> *In about 1977 or 1978 Les Hoyle and I [Figure 113] became the team for Washington for many years - well into the late 1980s. He was a school teacher.*
>
> *In 1995 Karen Ripley was the WDNR observer; I did not fly because I was working on a pilot Forest Health Monitoring project. I retired in 1996 and came back to fly aerial survey for WDNR and never mastered a map again!! The last year I flew was 1997.*[201]

The Environmental Protection Agency (EPA) banned the use of DDT, June 14, 1972.

[200] Sprengel, K.W. 1996. 50 years of aerial survey presentation. Portland, OR. R6 aerial survey program files. Sandy, OR.

[201] Personal communication with Bob Backman, March 6, 2016.

1973:

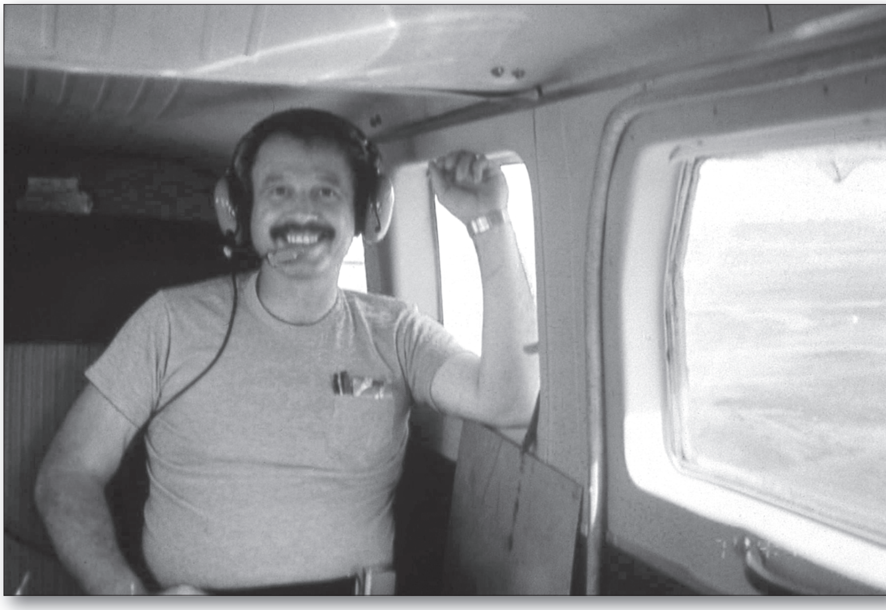


Figure 111. *Paul Joseph (ODF). Photo courtesy ODF.*

ODF: Paul Joseph (Figure 111) was hired as a technician to assist the Forest Entomologist in May and Jack Prukop was added to Air Operations as the second full-time pilot.

From Sprengel's *50 Years of Aerial Survey*:

> *Jack Prukop started flying when he was 17. He received his commercial license in 1963 and got a job in Ellensburg flying fire partrol. He also flew helicopters in Vietnam and later worked with Eagle Air Service out of Sitka, AK flying missions for AK pulp mills and the US Forest Service. While in Tacoma earning his mechanics license he heard of a job with ODF. He was hired in 1973 and has been flying the insect detection surveys ever since….Bob Franklin, one of the ODF pilots flying the survey when Jack started broke Jack in, which didn't take much….he currently has 35 years of flying experience and an outstanding safety record. Jack feels that either people have a knack for the survey or they don't, and it doesn't take too long to figure it out.*[202]

From Bill Ciesla:

> *1973 was the year that the tussock moth outbreak blew up in the Blue Mountains of Oregon. R-6 did a careful job of mapping the defoliation from a helicopter. This was part of the data used to justify a request for emergency use of DDT in portions of OR, WA, and ID. The request was a joint venture between R-6 and R-1.*[203]

From *Douglas-fir Tussock Moth Entomological Evaluation Oregon and Washington 1972-1973*:

> **Evaluation Procedures:**
>
> 1. *The active areas of the tussock moth were first located and mapped during the annual detection surveys. When the magnitude of the infestation was realized, additional flights were made in fixed-wing aircraft in the Blue Mountains and in the Lake Roosevelt areas. The area surveyed was gridded by flight lines two miles apart and all defoliation believed to be caused by the tussock moth was sketched on half-inch USFS maps or USGS-15 minute quad maps. These flights were made during July and August 1972.*

[202]Sprengel, K.W. 1996. 50 years of aerial survey presentation. Portland, OR. R6 aerial survey program files. Sandy, OR.

[203]Personal communication with Bill Ciesla, May 6, 2016.

2. *The need for a more accurate map showing the degree of damage developed when the first attempt was made to evaluate the timber losses in the Blue Mountains area. During September an aerial survey of the timbered area from Pomeroy, Washington, south to La Grande, Oregon, was made by helicopter. With the helicopter, time was taken to check out each drainage and small island of timber. The helicopter could move in close enough so that the observer could map all visible defoliation in one of the following classes:*

    Tree killing – *Fifty percent or more of the host trees within these areas have been completely defoliated and the remainder have heavy defoliation*

    Top killing – *Fifty percent or more of the host trees have at least the top quarter of the crown completely defoliated.*

    Defoliated – *The current year's foliage had been removed on most of the host trees but less than a quarter of the crown has been completely defoliated. This defoliation is visible from survey aircraft.*

3. *The tussock moth was also reported by foresters and loggers as being active in areas where damage was not visible during the helicopter survey. To determine the extent and location of these areas, survey scouts were directed to drive all roads adjacent to the units that had been mapped as moth-infested during the helicopter survey. At intervals of one mile the scout examined the foliage of host-type trees and recorded the presence or absence of the tussock moth, tussock moth damage, or egg masses.*

4. *After the helicopter survey and the ground scouting were completed, maps were prepared showing the areas where moth activity had been observed. Entomological evaluation crews were assigned to collect data from each one-mile-square section within the areas mapped. Much of this area is roadless and it was not possible to examine all sections, but the crews hiked or were air lifted by helicopter into many places otherwise inaccessible. Working in this manner the evaluation crews collected data from over 2,300 sections during an eight-week period in October and November of 1972.*[204]

From 1973 WFIWC proceedings *Value of Visual Aerial Detection Surveys:*

Aircraft requirements changed over the years with small, low horse-power, single engine airplanes used in the earliest days. As aircraft design and performance improved, aerial detection flying gradually shifted to larger planes with greater horsepower. Some Regions now do almost all of their flying with twin engine aircraft. This is particularly true of flying over rugged terrain and at higher elevations where high performance aircraft are essential to the maintenance of safety standards. Most State and Federal agencies in the western U.S. and Canada now have strict standards for both aircraft and pilots that apply to aerial detection flying…

Intensity of flying varies considerably from one [USFS Region] to another. Some … are being flown to detect only the major insect activity, while others are flown to detect all insect damage that can be identified on all forested lands. Again, some Regions are attempting to fly most of their lands each year, whereas others are flying the chronic problem areas only. Others are placing some areas on an intermittent aerial detection schedule, with flights planned every second or third year.

Detection flying in most regions … is being done from a central office. One Region reported the delegation of this flying to field units scattered over the Region. Both methods have advantages and disadvantages. Where flying is centralized there is less turnover in personnel but field units are less involved and greater efforts are required to assure that detection data are supplied to the field units. Use of microfilm was mentioned as a means of making aerial survey maps available to field units. This method is limited at present because of the availability of microfilm readers at many field units.

Where field units do the flying, turnover in personnel requires continual training. Consistency of aerial sketch mapping is more difficult where many persons are involved, but knowledge of pest conditions by field personnel may be improved by this firsthand involvement.[205]

[204]USDA Forest Service. 1973. Appendix A – Douglas-fir tussock moth entomological evaluation Oregon and Washington 1972-1973 In: USDA Forest Service Environmental Statement Douglas Fir Tussock Moth Pest Management Plan, 1973 (OR, WA). Portland, OR: Pacific Northwest Region. 67 p.

[205]Downing, G.L. (moderator). 1973. Value of visual aerial detection surveys. In: WFIWC proceedings. p. 85-86.

From *Forest Pest Conditions in the Pacific Northwest 1973*:

> *Forest pest infestations were detected and recorded by aerial and ground surveys in cooperation with the Washington State Department of Natural Resources and the Oregon State Department of Forestry. Ground surveys were made to verify aerial survey observation, detect and monitor low level populations, evaluate conditions and trends, and to establish control needs and boundaries.*[206]

1974:

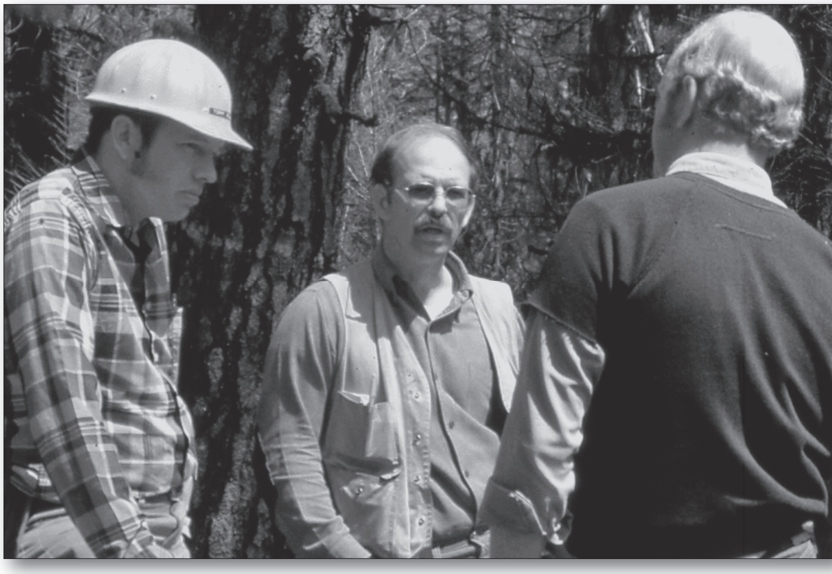


Figure 112. *Tommy Gregg and Donald Curtis. Douglas-fir tussock moth damage evaluations. USFS R6 Aerial Survey Collection.*

From *Forest Pest Conditions in the Pacific Northwest 1974*:

> **Introduction**
>
> *Forest insect outbreaks were detected and recorded during aerial and ground surveys made in cooperation with the Washington State Department of Natural Resources and the Oregon State Department of Forestry. Ground surveys were made to verify aerial survey findings, detect low-level pest populations, and to evaluate stand conditions.*
>
> *The volume of timber killed by bark beetles, except for the pine engraver (Oregon pine* ips*), was estimated from counts of dead trees made during the aerial survey. Volume losses resulting from defoliators, sucking insects, pine engravers, and diseases were not estimated.*
>
> **Major bark beetle problems**
>
> *The volume of timber killed by all bark beetles, except Oregon pine* ips *is determined from data recorded during the annual aerial detection survey. This is done by estimating the number of infested trees in each observed outbreak and applying an average volume for each tree. These volumes vary according to tree species, size class, and area infested.*[207]

From *Douglas-fir Tussock Moth in the Blue Mountains* – a recap of the 1971-1974 Douglas-fir tussock moth outbreak by USFS silviculturist David C. Powell of the Umatilla National Forest:

> *The next broad-scale tussock moth outbreak affecting the northern Blue Mountains occurred in the early 1970s. The first damage was noticed as 2,400 acres of defoliation in the Okanogan Valley of north-central Washington in 1971. In 1972, over 197,000 acres were defoliated in Oregon and Washington.*

[206]Pettinger, L.F.; Johnson, D.W. 1974. Forest pest conditions in the Pacific Northwest 1973. Portland, OR: USFS, Division of Timber Management, Insect and Disease Control Branch. p. 1.

[207]Curtis, D.J.; Johnson, D.W. 1975. Forest pest conditions in the Pacific Northwest 1974. Portland, OR: USFS, State and Private Forestry, Insect and Disease Control. p. 1 and 4.

Perhaps some of the worst tussock moth damage occurred on the northern half of the Umatilla National Forest. By 1974, 44% of defoliated acreage in the outbreak area (including state, private, and other federal ownerships) was on the Umatilla National Forest – 353,850 acres out of a total outbreak area of 800,000 acres!

How did the Umatilla National Forest respond to the 1970s outbreak? The Forest Service acted quickly and decisively to tussock-moth damage, and the political aspects of that story are fascinating.

DDT, the powerful chemical insecticide used in the 1948 spray project near Troy and for experimental control of western spruce budworm populations on the Heppner Ranger District and adjacent Kinzua Pine Mills lands, was found to affect many other organisms beyond insects that defoliate trees. Due to its environmental persistence and the broad spectrum of organisms affected by it, William Ruckelshaus, director of the Environmental Protection Agency, banned DDT on June 14, 1972.

From the perspective of the 1970s tussock moth outbreak, the EPA's ban couldn't have come at a worse time. Banning DDT removed the most effective weapon against tussock moth during the first year of what would turn out to be the largest and most severe outbreak ever recorded.

*Following the DDT ban, the Forest Service immediately began testing other potential insecticides. Testing included Zectran, carbaryl (Sevin), Pyrethroid, and Dylox, all of which were chemical compounds, and two possible biological control agents –*Bacillus thuringiensis *(a bacteria) and a natural virus.*

After a Forest Service petition requesting emergency use of DDT was denied by EPA in June 1973, 32,000 acres of the Walla Walla watershed was sprayed immediately with Zectran as a test project.

On Thursday, August 16, 1973, when United States Senator Bob Packwood was reviewing tussock moth damage near La Grande, Oregon, a forest fire broke out near Perry and burned nearly 6,000 acres in a short period of time, including an area damaged by tussock moth. This Rooster Peak fire directly threatened La Grande, burning several homes at its edge and coming within yards of others.

Over 1,500 people fought the Rooster Peak fire, and many of them were local residents of La Grande. The National Guard was activated to help evacuate homeowners from foothill areas. Shortly after this fire event, an area-wide fire closure was implemented because of high fire danger from tussock moth damage and an on-going drought.

Initially, Senator Bob Packwood had no official position regarding EPA's ban on the use of DDT. Following the Rooster Peak fire and after examining thousands of acres of tussock-moth damage from both the air and the ground, Senator Packwood eventually expressed this opinion regarding the DDT ban: "But, now I'm convinced their decision was wrong" *(referring to EPA's decision not to authorize use of DDT for tussock moth control).*

Following Packwood's visit and the Rooster Peak fire, petitions began circulating in northeastern Oregon requesting that the EPA's ban be lifted so that DDT could be used against tussock moth. On August 31st of 1973, Secretary of Agriculture Earl Butz visited the Blue Mountains to view tussock moth damage firsthand.

In January 1974, the EPA held hearings in Portland to consider possible DDT use against tussock moth. On January 30, 1974, the Tussock Moth Control Association of La Grande, Oregon presented petitions containing 57,000 signatures to Vice President Gerald Ford; the petitions requested that DDT be allowed for emergency use against tussock moth. On February 26, 1974, EPA director Russell Train authorized emergency use of DDT against tussock moth only.

After a Johnny Appleseed clean-up weekend in early June 1974, when 2,000 four-wheel drive club volunteers performed clean-up work in tussock moth damaged areas, a tri-Region, tri-State DDT spray project began on June 9, 1974 on the Colville Indian Reservation. By June 22, DDT spraying was underway in the Blue Mountains, eventually concluding on July 25, 1974.

. . .

Although applying an insecticide was the primary Forest Service response to tussock moth defoliation, salvage sales to harvest damaged and dead timber were also completed. The first Umatilla National Forest salvage sale was sold on November 28, 1972. The last of 40 tussock-moth salvage sales was awarded on September 3, 1974.

. . .

The following notes, which were prepared by Paul Bouchard (retired forester), describe how the Pendleton Ranger District responded to the tussock moth outbreak (note: this portion of the Umatilla National Forest had more impact from tussock moth than other ranger districts).

> *"The 1973 aerial [helicopter] sketch map showing tussock moth defoliation became the planning map for the salvage timber harvest program. The heavy infestation and damage areas were used to rough out potential timber sale area boundaries. By estimating the potential treatment area and timber volume by damage classes, a rough estimate of total sale acreage and salvage volume was then available for program management purposes (personnel, supplies, funding needs, etc.).*
>
> *It was estimated that the tussock moth salvage program could involve as much as 210 million board feet of timber volume from a gross analysis-area acreage of 66,000 acres, of which 38,000 was forested. All of the potential treatment areas were reconnoitered from the air and sale area boundaries then established on 4-inch-to-the-mile aerial photographs enlarged from a 1970 high-altitude reconnaissance flight. . . ."*[208]

[208] Powell, D.C. 2008. Tussock moth in the Blue Mountains. 7 p.

Chapter 7
The survey moves to State and Private Forestry – 1975-1993

Federal administrative survey responsibility: USDA Forest Service, Pacific Northwest Region, State and Private Forestry branch, Forest Pest Management

Sometime in late 1974, the Insect and Disease Control group moved out of Timber and out of the National Forest Systems branch of the Forest Service. For the first time the group became an independent staff in the State and Private Forestry branch of the Forest Service. David Graham, Chief of the Insect and Disease Control group in Timber, became the group's Director.

Successive staff name changes from 1975-1993 included: Insect and Disease Control (IDC); Forest Pest Control (FPC); Insect and Disease Management (IDM); Forest Insect and Disease Management (FIDM); and Forest Pest Management (FPM). For ease of reference, the staff is referred to as FPM throughout this chapter.

In 1977 David Graham moved to the WO, and Paul Buffam returned to R6 as the FPM Director. Paul Buffam retired in 1986, and for two years the director position was vacant while various FPM staff served as acting Director.

In 1988, Bill Ciesla filled the vacant Director position.

From 1988-1990, the RO staff was decentralized and three zone offices were created. From Ciesla's Founders Award address:

> *Another initiative in which I was involved was the decentralization of the Forest Pest Management function. Up to that time, all of the Forest Pest Management specialists had been located in the Regional Office in Portland. We established a zone office attached to the Wallowa-Whitman NF in La Grande, OR and another attached to the Deschutes NF in Bend OR. Several years later, we chartered a third zone office on the Wenatchee NF in Wenatchee, WA to serve all of Washington east of the Cascades. This initiative was a success because it put specialists closer to the field and reduced the number of days they had to spend away from home.*[209]

Bill Ciesla left R6 for an assignment with FAO in June 1990.

Max Ollieu filled the vacant GS-15 Director position behind Bill Ciesla in November 1990.

For additional administrative details, see Appendix 2.

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[209]Ciesla, W.M. 2006. William M. Ciesla Founders Award Address: Forest Health Protection Under a Wandering Star. Western Forest Insect Work Conference.

1975:

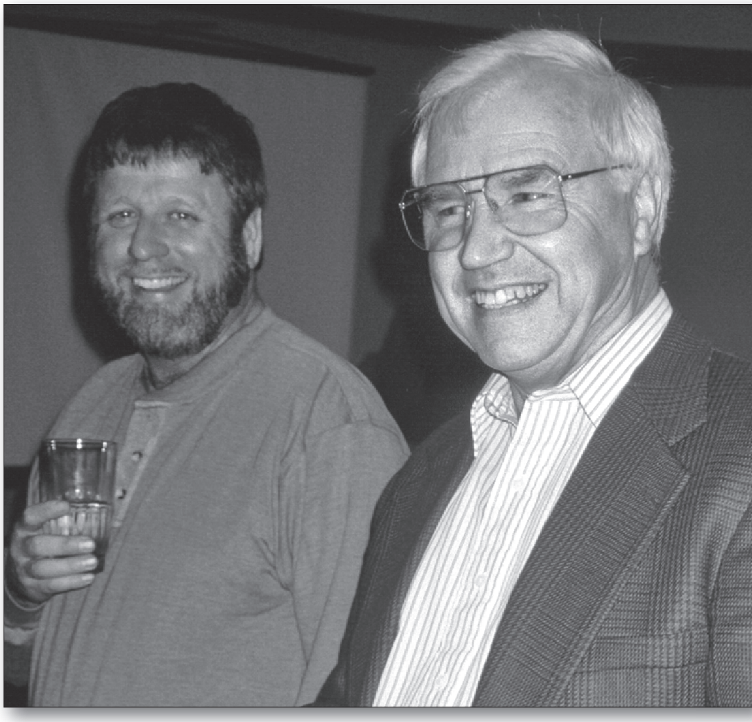


Figure 113. *Bob Backman (left) and Les Hoyle in 1996 at the 50 Years of Aerial Survey celebration. USFS R6 Aerial Survey Program Collection.*

From Sprengel's *50 Years of Aerial Survey* presentation:

> *Sort of a mixed blessing during Les Hoyle's employment were the introduction of better maps at slightly larger scales, but they shrunk the coverage of a single map so more maps were needed to get the same coverage. Another improvement noted was the improved communications systems: headsets with connections to King radios. Regional meetings with dispatchers and Les' pre-season travels and personal visits with dispatchers helped further improve communications.*[210]

Director David. A. Graham received the Western Forestry Forest Protection award, *"In recognition of outstanding service in forest protection."*[211]

From the ODF November *Forest Log*:

> *This year our annual aerial insect survey was done only in Eastern and Southwest, Oregon, concentrating on the highest hazard areas, [LeRoy] Kline indicated.* "I can say, as a professional entomologist, that insect problems this year in Oregon are the worst I've ever seen." [212]

Silviculturist David Powell recalled the mountain pine beetle outbreak and the use of aerial sketch maps:

> *For the Blue [Mountains], the big MPB outbreak was first reported in 1968 near Johnson Rock on the Wallowa-Whitman NF. By the fall of 1975, almost one and ½ million acres of lodgepole pine had been affected in the Blues. For example, the*

[210]Sprengel, K.W. 1996. 50 years of aerial survey presentation. Portland, OR. R6 aerial survey program files. Sandy, OR.

[211]WFCA. 1976. Proceedings of the Western Forest and Conservation Associaton 1975.

[212]The Forest Log. November 1975. p. 4

Figure 114. *Tommy Gregg (left) and Bob Harvey folding paper survey sketch maps on the hot tarmac for the next flight leg. The nomex flight suits were required for surveyors in the 70s and on into the 80s. Note: The airplane in the background is not a survey plane; they are working in the shade of their high-wing survey plane. USFS R6 Aerial Survey Program Collection.*

1975 aerial survey detection map showed a large contiguous concentration of MPB activity stretching from southeast of Prairie City (Malheur NF) north to Meacham (Umatilla NF). Smaller activity centers were scattered around the periphery of this large swath from west of Seneca north to Asotin County, Washington (Pomeroy RD of the Umatilla NF). Much of the mature lodgepole pine type in the central Blues, encompassing what were then the Baker, Bear Valley, Long Creek, North Fork John Day, Heppner, Prairie City, and Heppner ranger districts, was killed during this outbreak. Bill Carter, who coordinated much of the Umatilla NF's response to the mid-1970s MPB outbreak, used the aerial survey detection mapping extensively when planning for salvage sales and other MPB mitigation activities.[213]

From *Forest Pest Conditions in the Pacific Northwest during 1975*:

Major contributors responsible for both the survey effort and preparation of this publication include:

Oregon State Department of Forestry:
LeRoy N. Kline, Entomologist, Insect and Disease Section
Larry Weir, Pathologist Insect and Disease Section
Paul Joseph, Forest Technician, Insect and Disease Section
Gene Irwin, Forest Technician, Insect and Disease Section

Washington State Department of Natural Resources:
Rick Johnsey, Entomologist, Forest Land Management Division
Ken Russell, Pathologist, Forest Land Management Division
Bob Backman, Forest Technician, Forest Land Management Division

Forest Service, R-6:
Donald J. Curtis, Entomologist, Insect and Disease Management
Tommy F. Gregg, Forestry Technician, Insect and Disease Management
David G. Laws, Forestry Technician, Insect and Disease Management
Leon F. Pettinger, Entomologist, Insect and Disease Management
James S. Hadfield, Pathologist, Insect and Disease Management
Robert D. Harvey, Jr., Biological Technician, Insect and Disease Management

Aerial surveys were not flown in most portions of western Oregon and western Washington in 1975 (see Map 1 in Appendix). This decision was based on the fact that very little damage caused by any insect had been observed in these areas within the past 5 years.

In lieu of the aerial survey, forest managers were requested to increase their field surveillance and promptly report any observed insect activity. If any problems are detected, special surveys will be flown upon request. No requests for special surveys were received by the two State agencies or the Forest Service in 1975.

No area has been permanently omitted from consideration for aerial detection. The decision to add or delete areas, based on known insect activity or requests by land managers, will be made each year prior to the beginning of the survey.[214]

From *Forest Insect and Disease Conditions in the United States 1975*:

The need for more accurate estimates of losses and total impact on all forest resources is becoming more essential for use in forest management planning. Subsequently, in 1975 the Forest Service began planning the establishment and staffing of a Methods Application Group whose responsibility would be to identify, evaluate, and help implement new impact survey technology. An additional responsibility of the MAG would be to provide technical assistance to Federal and State forest insect and disease management specialists for pilot projects that would evaluate promising chemical and nonchemical suppression technologies for forest pests.[215]

[213]Personal communication with David C. Powell, May 19, 2016.

[214]USDA FS: ODF; WDNR. 1976. Forest pest conditions in the Pacific Northwest during 1975. Portland, OR: State and Private Forestry, Insect and Disease Management; Salem, OR: Insect and Disease Section; Olympia, WA: Forest Land Management Division. p. 1.

[215]USDA FS. 1977. Forest insect and disease conditions in the United States 1975. Washington, DC: Forest Insect and Disease Management. Introduction – p. ii.

From Bill Ciesla's 2006 Founders Award Address:

MAG [Methods Application Group] (Davis CA - 1975-81, Fort Collins, CO 1981-88)

In 1975, Russ Smith, who had now become Director of Forest Pest Management with USDA Forest Service in Washington DC, chartered the Forest Pest Management/ Methods Application Group (MAG, known today as the Forest Health Technology Enterprise Team {FHTET}) and selected me to direct this new initiative. This group, whose function was to evaluate and implement new technologies, especially for assessment of pest impacts, was originally established in Davis, CA and later relocated to Fort Collins, CO.

. . .

One of the technologies we began to evaluate early on at MAG was geographic information systems (GIS). The ability to integrate spatial information on insect and disease damage with land ownership, vegetation types and other thematic map layers and generate data tables using a computer was, to us in MAG, a fascinating concept. Soon terms such as "polygons, arcs, points, digitizing" and "overlay processing" became an integral part of our vocabulary. Unfortunately, there were people in the Forest Service that didn't share our enthusiasm and had some real concerns about committing to this technology. For a time, a moratorium was placed on GIS development and implementation in the Forest Service until some basic issues could be addressed. However, after we moved to Fort Collins, we developed a partnership with the Western Energy Land Use Team (WELUT) of the U.S. Fish and Wildlife Service [USFWS], which had an office in the same complex we were housed. This group had developed one of the first working and user friendly GIS, a system known as the Map Overlay Statistical System (MOSS). Together we conducted a number of tests and demonstrations with this system (Pence et al. 1983), organized GIS training sessions and eventually made a copy of the MOSS software available to R-6.[216]

1976:

Figure 115. *Bob Harvey (USFS). USFS R6 Aerial Survey Program Collection.*

From 1976 WFIWC proceedings, *Workshop: Detection, Monitoring, and Survey Methods*:

Computer Mapping of Aerial Insect and Disease Surveys – Wayne Bousfield [Missoula, MT]
We are currently working a system to digitize aerial insect and disease surveys for the purpose of computer mapping and for acreage determination.

[216]Ciesla, W.M. 2006. Founders award address: Forest Health Protection under a wandering star. WFIWC. http://wfiwc.org/awards/founders-award/speech/ciesla

Currently we do not provide a map for all interested parties and our acreage calculations are becoming a burden. We feel that a digitized mapping system is essential if the detection work is to be useful to all land managers.

Basically there are three types of computer mapping systems, (1) line segments, (2) closed polygon, and (3) grid format. We are looking closely at the polygon system because it seems to have fewer problems. Once we have the ownership in digital format by units of land (National Forests, State Forests, Indian Lands, etc.) then the pest problem layer is updated each year. We are looking for 7 to 10-day turnaround time between aerial survey completion and providing all land managers with a map of pest problems.[217]

From *Forest Pest Conditions in the Pacific Northwest during 1976*:

Major contributors responsible for both the survey effort and preparation of this publication:

Oregon State Department of Forestry:
LeRoy N. Kline, Entomologist, Insect and Disease Section
Larry Weir, Pathologist Insect and Disease Section
Paul Joseph, Forest Technician, Insect and Disease Section
Gene Irwin, Forest Technician, Insect and Disease Section

Washington State Department of Natural Resources:
Rick Johnsey, Entomologist, Forest Land Management Division
Ken Russell, Pathologist, Forest Land Management Division
Bob Backman, Forest Technician, Forest Land Management Division

Forest Service, R-6:
David R. Bridgwater, Entomologist, Forest Insect and Disease Management
Tommy F. Gregg, Forestry Technician, Forest Insect and Disease Management
David G. Laws, Forestry Technician, Forest Insect and Disease Management
Leon F. Pettinger, Entomologist, Forest Insect and Disease Management
James S. Hadfield, Pathologist, Forest Insect and Disease Management
Robert D. Harvey, Jr., Biological Technician, Forest Insect and Disease Management[218]

1977:

Figure 116. *David Bridgwater, project entomologist. Western spruce budworm plot training, May 27, 1983. USFS R6 Aerial Survey Program Collection.*

[217]Bousfield, W.E. 1976. Computer mapping of aerial insect and disease surveys. In: WFIWC proceedings, March 1-4, 1976. Wemme, OR. Prepared by: Intermountain Forest and Range Experiment Station, Ogden, UT. p. 77

[218]USFS: ODF; WDNR. 1977. Forest pest conditions in the Pacific Northwest during 1976. Portland, OR: State and Private Forestry, Forest Insect and Disease Management; Salem, OR: Insect and Disease Section; Olympia, WA: Forest Land Management Division.

From Sprengel's *50 Years of Aerial Survey:*

> *Dave Bridgwater [Figure 116] started flying survey in 1977, because his job description said he would. A little aerial survey work in the northeast area in the mid 70's probably helped make him a shoe-in for the position. Once again, he was told to get in the back seat and not to miss anything. Dave started making points early with the Regional Aviation Group by asking the Regional Aviation Safety Officer,* "How come we have to pump down the gear on the 337 every time we land?" *I think Dave still sits on a donut pillow, and pays his dues by being a very effective Unit Aviation Officer and paying extra special attention to safety. He's never shy about questioning a situation that has even the most remote possibility of being unsafe.*[219]

From a 2006 oral history interview with David Bridgwater (DRB), conducted by Keith Sprengel (KWS) and Julie Johnson (JLJ):

> *KWS: How did you come to be involved in FHP aviation in aerial survey? Was it like me – somebody pointed at you?*
>
> *DRB: Yes! Basically they said you're going to do aerial survey – get in the plane and map.*
>
> *KWS: And that was in 1977, the year you showed up?*
>
> *DRB: Actually, I showed up in November of 1976, so it was the following field season. . . . The first couple of years I was just an observer and ground checker . . . kind of a survey monkey, rather than being involved in the entire working of the whole program.*
>
> *KWS: And who was your mentor?*
>
> *DRB: Tommy Gregg.*
>
> *KWS: And that was the extent of your training and safety program?*
>
> *DRB: Yes … His assumption was that since I had a bit of experience working on the ground with bark beetles and other insects that I would have a better idea of what the signatures were than someone who had never been out the field and worked with insects and diseases before.*
>
> *. . .*
>
> *DRB: When I started doing the survey, we actually had summer temporary crews that went out and did ground-checking for us and they would come back in and say this polygon was such and such and if the call from the air was wrong we would change it. If they found something that wasn't on the map we would add it to the map. There was one instance where we called it tussock moth and the ground crew brought back some branches and there were a couple sawfly larvae skin casts on the foliage so the entomology group leader changed it from tussock moth to sawfly damage, and the next year was the peak tussock moth defoliation year. It was called right by the aerial surveyor and called wrong by the ground crew.*
>
> *JLJ: You had ground crews checking survey data?*
>
> *DRB: Absolutely.*
>
> *JLJ: What years?*
>
> *KWS: From about 1947 till the late 70s?*
>
> *DRB: Yeah.*
>
> *JLJ: How many people were on those crews? Were they going out all summer checking?*
>
> *DRB: They were summer temporaries. I did some as a summer temp. We usually had two, two-people crews [one in each state]. They didn't do just aerial survey ground checks – they did other things. Actually the summer I worked here I didn't*

[219]Sprengel, K.W. 1996. 50 years of aerial survey presentation. Portland, OR. R6 aerial survey program files. Sandy, OR.

work on a ground crew per se*, I worked with one of the entomologists, but when we'd go out, if there was a polygon that an aerial surveyor wasn't sure of, we'd check it.*

JLJ: So that's one of the things that we haven't re-implemented since that 80s break in the survey program is the ground surveys.

DRB: Uh-huh. Well, actually, we've gotten back to it a little bit – but still, nothing compared with two, two-person ground crews out there.

…

JLJ: What planes were you flying then?

DRB: The first airplane we flew in then was the ODF 206. We flew also in Skymasters, 185s, 182s, 210s, and later Partenavias.

JLJ: So that's a sequence of planes that ODF had, or you just had options?

DRB: No – initially in WA we were flying call-when-needed (CWN) Skymaster, 182, or 206. In Oregon we flew with ODF aircraft which was a 206. Many years we also had another contract CWN aircraft in Oregon, so we were often flying two aircraft in Oregon.

…

DRB: When I started in the 70s we had a lot more people doing a lot more stuff, but the work was a lot more labor intensive. I mean you'd spend almost as much time working on your maps as you did flying just to get the product out. And our goal in those days was when we had a finished forest map to get it out two weeks after the map was finished. And that's the black-line out to our customers. Two weeks.

KWS: That's pretty quick with all the work that was involved.

DRB: Well, you needed a lot of people to do that to get it out that fast. But that was all demand driven, because people wanted current maps quickly, so they could go out and set up salvage sales that year and capture the volumes as soon as possible.

KWS: And that also made the ground-checking portion more important, as well.

DRB: Absolutely … when I started we had three airplanes and six aerial observers. All well-schooled aerial observers except for the new kid on the block – that was me.

KWS: The salvage relationship.

…

JLJ: Can you describe processing data in 1977 from collection to reporting?

DRB: Sure! Flew a grid pattern and used ½ inch to the mile recreation maps which covered all the forested lands back then. Most years, we flew all forested lands. We used the current coding system for the polygons – although some codes have been added and updated. Fewest number of trees we mapped in those days were 5 trees/poly or ¼ tree/acre. Brought the two flight maps back into the office, laid on a light table and all polygons were mastered on to a final paper map. We then transferred those polygons to a cronoflex.

JLJ: Can you describe what a cronoflex is for those who may not know?

DRB: It's a clear piece of mylar with the same forest information and scale as the forest visitor map. We would make a paper copy from that with a machine – a blackline machine. We hand drew and hand attributed all the polygons. Then we would take a paper copy and divide all the polygons by ownership by Forest Service or State and Private or Other Federal and then we would color code the polygons. Then we would dot-count acres by each ownership for each polygon and hand tabulate the number of acres by pest and ownership.[220]

[220]Sprengel, K.W.; Johnson, J.L. 2006. Oral history interview with David R. Bridgwater. August 18, 2006. Portland, OR. R6 aerial survey program files. Sandy, OR.

The 1977 regional conditions report (published in 1978) was the first year that the Northwest Forest Pest Action Council was not mentioned in the introduction as a sponsor of the aerial survey[221]:

> *This is the 30th annual report of forest pest conditions in Oregon and Washington based on cooperative aerial and ground surveys conducted by the Forest Service, Oregon State Department of Forestry, Washington State Department of Natural Resources, and the surveillance efforts of private, State, and Federal foresters.*
>
> *The purpose of this report is to provide public and private land managers with information concerning pest conditions and to maintain a historical record of pest trends and occurrences.*
>
> **Major contributors responsible for both the survey effort and preparation of the 1977 Conditions Report include:**
>
> **Oregon State Department of Forestry:**
> *LeRoy N. Kline, Entomologist, Insect and Disease Section*
> *Larry Weir, Pathologist Insect and Disease Section*
> *Paul Joseph, Forest Technician, Insect and Disease Section*
> *Gene Irwin, Forest Technician, Insect and Disease Section*
>
> **Washington State Department of Natural Resources:**
> *Rick Johnsey, Entomologist, Forest Land Management Division*
> *Ken Russell, Pathologist, Forest Land Management Division*
> *Bob Backman, Forest Technician, Forest Land Management Division*
>
> **Forest Service, R-6:**
> *David R. Bridgwater, Entomologist, Forest Insect and Disease Management*
> *Tommy F. Gregg, Forestry Technician, Forest Insect and Disease Management*
> *David G. Laws, Forestry Technician, Forest Insect and Disease Management*
> *Leon F. Pettinger, Entomologist, Forest Insect and Disease Management*
> *James S. Hadfield, Pathologist, Forest Insect and Disease Management*
> *Donald J. Goheen, Pathologist, Forest Insect and Disease Management*
> *Robert D. Harvey, Jr., Biological Technician, Forest Insect and Disease Management*[222]

Paul Buffam, FPM Director from 1977-1986, had this 2016 reflection about surveyors:

> *Being an aerial survey person is a very difficult, tedious, and important job. Sitting in an airplane for four or more hours a day, trying to figure out the cause of mortality or color change on trees several thousand feet below and also the species involved, while trying to keep your location on a map takes lots of experience, skill, patience, and fearlessness.*[223]

1978:

Figure 117. *Tommy Gregg (USFS) at the 50 Years of Aerial Survey celebration, 1996. USFS R6 Aerial Survey Program Collection.*

The Cooperative Forestry Assistance Act (CFAA) of 1978 replaced the 1947 Forest Pest Control Act (for full text of the CFAA, see Appendix 3.3.4).

[221]Paul Buffam said he attended a NFPAC meeting in the fall of 1977. He did not remember when the Council disbanded, but thought it was sometime soon after that.

[222]USDA FS: ODF; WDNR. 1978. Forest pest conditions in the Pacific Northwest during 1977. Portland, OR: Forest Insect and Disease Management; Salem, OR: Insect and Disease Section; Olympia, WA: Forest Land Management Division.

[223]Personal communication with Paul Buffam, May 2, 2016.

The first Calibration and Conformity (C&C)[224] training was held in 1978 east of La Grande, Oregon and "there was "mountain pine beetle everywhere". Bill Ciesla, of the Methods Application Group (MAG, at the time), and Tim McConnell (WDNR, at the time), both attended.[225]

From 1978 WFIWC proceedings *Method Applications Group: Purpose and Accomplishments*:

> *The U.S. Forest Service, Forest Insect and Disease Management/Methods Application Group (FIDM/MAG)[226] was established in August 1975. Its mission is to improve FIDM program and project activities through technical assistance and implementation of new knowledge. The unit is staffed with a team of specialists which provide skills not normally available in Region/Area FIDM staffs such as biometrics, computer science, remote sensing, and pesticide application technology. FIDM/MAG's mission is national in scope and is administratively … attached to the Director of FIDM in the Washington Office.*
>
> …
>
> *Types of services that the unit should provide include:*
>
> 1. *Function as a repository for models and other national data management systems. Provide training in system use.*
> 2. *Continue evaluation of alternative computer mapping systems for storage and retrieval of survey data.*
>
> …
>
> *Region and Area FIDM staffs should actively seek assistance from MAG specialists. MAG activities should relate to the management job on the ground. Level of communication should increase to maximize effectiveness of national specialists and keep them responsive to the needs of the field.[227]*

April 4-6, 1978, Boise, ID: *Westwide Forest Insect and Disease Aerial Sketch Mapping Workshop*

> *To: Regional Forester, Regions 1-6 and 10*
>
> *A 5200 memo, December 28, 1977, was circulated to Regions 1-6 and 10 proposing a westwide workshop on aerial sketch mapping to be held in Boise, Idaho. Positive responses were received from all Regions and fiv e states. The workshop has been scheduled for April 4-6, 1978, and will be co-sponsored by S&PF, FI&DM, R-4 and WO-FIDM, MAG, Davis, CA.*
>
> …
>
> *This workshop, we believe, is long overdue. We look forward to the opportunity of discussing and hopefully resolving a myriad of mutual problems.*
>
> **Agenda:**
> *Welcome and introduction – M. Ollieu [R4, at the time]*
> *Overview of Aerial Sketch Mapping – B. Klein*
> *Review of Aerial Survey Programs by Region*
> *Objectives – R. Williams*
> *Survey Requirements*
> - *What data are required – B. Dolph*
> - *Accuracy and Ground Checking– L. Stipe*
> - *Expertise – L. Yarger*
> - *Centralization vs. decentralization – M. Ollieu*
> - *Operational aspects – S. Tunnock*
> - *Role of detection surveys in the biological evaluation process – D. Parker, T. Smith*

[224]The name Calibration and Conformity (C&C) was given to this training session sometime in the 90s by Michael McWilliams.

[225]Personal communication with Tim McConnell, August 1, 2015.

[226]The Methods Application Group (MAG) function was later absorbed by the Forest Health Technology Enterprise Team (FHTET).

[227]Ciesla, W.M. 1978. Methods application group: Purpose and accomplishments. In WFIWC proceedings, March 7-9, 1978; Durango, Colorado. Prepared at the Oregon Department of Forestry, Salem, OR. p. 74-76.

Aerial observer training – D. Parker, T. Smith
Standards
Guidelines
Techniques
Special equipment – J. Caylor
Contracts – W. Bailey
Alternatives to aerial sketch mapping – L. Kline
Aircraft types – J. Knopf
Aerial surveys from the pilot's viewpoint – J. Holman
Accuracy of visual estimations – B. Heller
Dissemination of data to user – R. Johnsey
Safety – J. Knopf
Life insurance – L. Livingston
Computerized mapping – B. Young and T. Gregg
Looking beyond with computerized mapping – B. Young and T. Gregg

R6 USFS attendance: Tommy Gregg and Bob Dolph
WDNR attendance: Rick Johnsey
ODF attendance: LeRoy Kline[228]

At the meeting in Boise, Tommy Gregg said that Bob Young (MAG)[229] wanted R6 to change back to the pre-1969, L/M/H relative intensity method of mapping mortality. Region 6 could not comply, because National Forest customers needed the numbers of dead trees to assist with salvage operations.

Around this time, Tommy Gregg started moving towards data analysis, models, and GIS. In ~1979, he passed the aerial survey duties to Dave Bridgwater and pursued data and models full time.[230] David Powell spoke highly of Tommy's success with this job transition:

> *I first worked with Tommy in the late 1980s while stationed on the Malheur NF as assistant Forest Silviculturist in John Day. He was a consummate analyst! There was very little he couldn't do in terms of data analysis, and if there wasn't an existing program available for a certain analysis task, then by gosh, he would write it himself! I never knew how many programming languages Tommy was fluent in, but he was very adept at whipping out a custom software program to handle almost any data analysis need. I was also impressed with his considerable skills in running the FVS (Forest Vegetation Simulator) program (previously called PROGNOSIS). . . . Later, they added extensions to FVS to allow simulation of budworm impact and other insect or disease effects (including root disease and dwarf mistletoe). The late 1980s were the heyday of the budworm treatment era, so Tommy would usually come out to the units (either the Supervisor's Office or the district, depending on the circumstances) and begin working with the local folks to 'crunch the numbers' that would be needed for that year's budworm EA. Budworm treatment projects were so common then that it was not unusual for a Forest to have an EA every single year for budworm treatment. And as you can imagine, the first data layer brought into the analysis process was that year's aerial sketch map (and now that I know he used to be an observer, it explains why he knew how to use the sketch map data so well!). This was one reason for why Tommy always seemed to show up in the fall, and work with us off and on throughout the winter. Tommy's fall visits to the unit still occurred after I transferred to the Forest Silviculturist position on the Umatilla NF in 1991, but we didn't tend to see him as much then as in the 1980s because the zones had been established by then, and more of the data analysis interactions seemed to occur between Tommy and the zone entomologists (such as Don Scott).*[231]

[228]Hardcopy, R6 aerial survey program files. Sandy, OR.

[229]The Methods Application Group (MAG) later became the Forest Health Technology Enterprise Team (FHTET) in Fort Collins, CO.

[230]Personal communication with Tommy Gregg, September 25, 2015.

[231]Personal communication with David C. Powell, May 19, 2016.

Bob Franklin, ODF Chief Pilot, resigned and Jack Prukop was promoted to fill his position.

From *Forest Insect and Disease Conditions in the Pacific Northwest [in 1978*]:

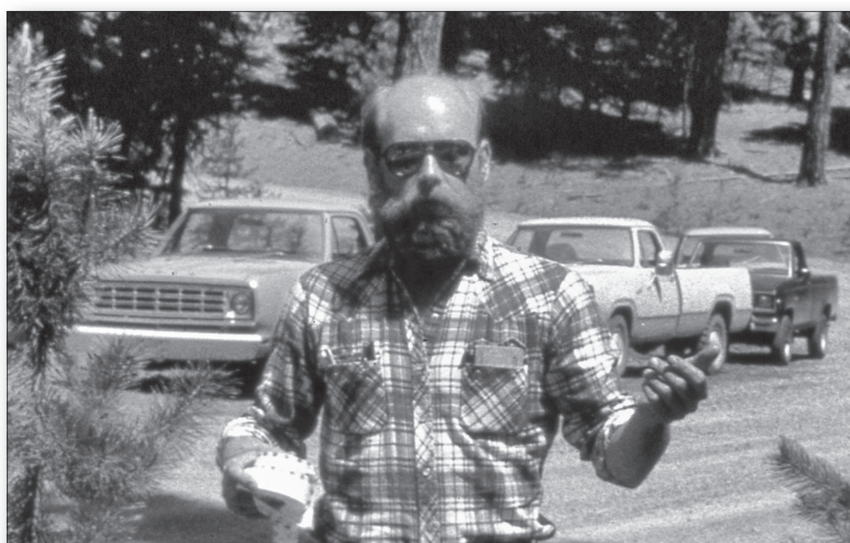
Major contributors to this publication

Oregon State Department of Forestry:
LeRoy N. Kline, Entomologist, Insect and Disease Section
Larry Weir, Pathologist Insect and Disease Section
Paul Joseph, Forest Technician, Insect and Disease Section
Gene Irwin, Forest Technician, Insect and Disease Section

Washington State Department of Natural Resources:
Rick Johnsey, Entomologist, Forest Land Management Division
Ken Russell, Pathologist, Forest Land Management Division
Bob Backman, Forest Technician, Forest Land Management Division

Forest Service, R-6:
Tommy F. Gregg, Forestry Technician, Forest Insect and Disease Management
David R. Bridgwater, Entomologist, Forest Insect and Disease Management
David F. Laws, Forestry Technician, Forest Insect and Disease Management
Leon F. Pettinger, Entomologist, Forest Insect and Disease Management
James S. Hadfield, Pathologist, Forest Insect and Disease Management
Donald J. Goheen, Pathologist, Forest Insect and Disease Management
Gregory M. Filip, Pathologist, Forest Insect and Disease Management
Robert D. Harvey, Jr., Biological Technician, Forest Insect and Disease Management[232]

1979:



Figures 118 & 118a. *After flying one season of aerial survey with WDNR in 1978, Tim McConnell was first hired by the USFS in a temporary position as an Aerial Survey Forestry Technician in 1979. USFS R6 Aerial Survey Program Collection.*

[232]USFS: ODF; WDNR. 1979. Forest insect and disease conditions in the Pacific Northwest [in 1978]. Portland, OR: Forest Insect and Disease Management; Salem, OR: Insect and Disease Section; Olympia, WA: Forest Land Management Division.

From Sprengel's *50 Years of Aerial Survey*:

> *Tim McConnell first worked in forest entomology with the WDNR in 1975 after receiving his BA in geography. He worked on a couple of western spruce budworm projects in 76/77. Rick Johnsey told Tim about the survey program and gave him his "break" by putting him up with Les Hoyle and Bob Backman as a trainee. Tim was later hired by the USFS in 1979…and flew in Region Six until 1991*[233]*….a good summer job that left the winters open for downhill skiing…a continuing passion. Tim worked hard while in Region Six to forge a good working relationship with the Regional Aviation and Dispatcher groups….we still benefit from the groundwork he laid while he was here…* [234]

From McConnell 1995a:

> *Thanks to the mentoring of senior observer Tommy F. Gregg, during the late 1970s in the Pacific Northwest Region, I was able to understand the importance of the aerial survey mission, its daily challenges to the observer and catch his infectious enthusiasm to capture on a map what can be seen from the air. Tommy says,* "Fly low and slow and don't miss anything." [235]

From a 1979 WFIWC Workshop *Making Aerial Surveys More Usable to Forest Resource Managers*:

> *Some of the main uses of the maps and data that were identified are as follows:*
>
> *1) Immediate and short term plans for salvage of mortality*
> *2) Long term planning and projecting timber supply*
> *3) 5-year action plans*
> *4) Setting priorities in assisting private landowners by State Service Foresters*
> *5) Industrial landowners scheduling special aerial flights or ground checks*
> *6) Management problems in designated parks, roadless areas, wilderness areas or those areas being considered as such under RARE II*
> *7) Historical record of trend of damage by species of insect, location, intensity, and damage*
> *8) Reporting accomplishment and accountability timber saved vs. timber loss*
> *9) Determining location of high-risk fuels (hazard rating) for fire prevention and suppression*
> *10) Information for lobbying for funding of pest management and research*
> *11) Public information and inquiry.*
>
> *Ways to improve the survey…*
>
> *1) To obtain more accuracy in location of problems, as this seemed to be the most important use*
> *2) Improve the accuracy of degree of damage*
> *3) Send the maps and data out to the users sooner, so action can be taken within the same season*
> *4) Record other types of damage such as animal, weather, etc.*[236]

[233]Tim took a one year temporary job in Corvallis working for John Teply and Eric Twombly; in 1988 director Bill Ciesla gave Tim a permanent appointment with FPM in the RO in Portland.

[234]Sprengel, K.W. 1996. 50 years of aerial survey presentation. Portland, OR. R6 aerial survey program files. Sandy, OR.

[235]McConnell, T.M. 1995. Proceedings aerial pest detection and monitoring workshop, April 26-29, 1994. Report 95-4. Missoula, MT: USDA Forest Service, Northern Region, Forest Pest Management. p. 50

[236]Kline, L. 1979. Making aerial surveys more useable to forest resource managers, In WFIWC proceedings, March 6-8, 1979. Boise, ID. p.136.

1980:

May 18, 1980 – Mt. St. Helens erupted.

From *Forest Pest Conditions during 1980 in the Pacific Northwest*:

> *Currently being kept under observation are Gifford Pinchot National Forest and adjacent State and private timber stands damaged or destroyed by the volcanic action of Mt. St. Helens. Conditions in these stands closely resemble the blowdown and flood damage to forests where former outbreaks of the Douglas-fir beetle developed. Plans have been made to salvage as much damaged timber as possible before 1983 when developing beetle broods are expected to emerge, attack, and kill healthy green trees surrounding the volcanic area.*[237]

LeRoy Kline (Figure 119) was promoted to Director of Insect and Disease Section with ODF.

1981:

Figure 119. *LeRoy Kline (ODF) sketch mapping. 1981. Photo courtesy ODF.*

From *Pacific Northwest Forest Pest Conditions During 1981*:

> *Although mountain pine beetle losses continued to decline throughout the Region, this beetle did maintain its current title as the most destructive tree killer in the Pacific Northwest.*[238]

From a 2006 oral history interview with David Bridgwater (DRB), conducted by Keith Sprengel (KWS) and Julie Johnson (JLJ):

> *JLJ: You said that it got to the point where they'd ask you to only fly to the hot spots on the west side – how did that go?*

[237]USDA FS: ODF; WDNR; Oregon Department of Agriculture. 1981. Pacific northwest forest pest conditions during 1980. Portland, OR; Salem, OR; Olympia, WA; Salem, OR. p. 6.

[238]USFS: ODF; WDNR; ODA. 1981. Pacific Northwest forest pest conditions during 1981. Portland, OR; Salem, OR; Olympia, WA; Salem, OR. p. 8.

DRB: Actually, in the years when we weren't going to fly the west side, someone would say well, we need this particular piece flown because we know there's some insect activity out there, and we would dead head down there and survey.

JLJ: Did you survey along the way?

DRB: If you were deadheading down and you saw something, you might put it down.

JLJ: So just because there's a polygon, it doesn't mean the whole area was surveyed? It sounds very happenstance.

DRB: Correct.

KWS: It sounds like it was very client-driven.

DRB: Very client-driven.

JLJ: And clients were?

DRB: Internal and external. Actually the survey was very client-driven. The reason we mapped a minimum of 5 trees actually came from Doug-fir and large Ponderosa pine, because that was a truckload and that was an economical basis for doing salvage.

KWS: So salvage was a driving force in establishing mapping thresholds?

DRB: In those days we had the Pest Action Council here in the Northwest and it was made up of FS, States, Research and private industry. And everyone was quite interested in what we found in the surveys and a lot of it was geared towards salvage sales.

KWS: So, it's interesting what drove the survey, which makes it difficult for us now-a-days to determine how it was flown and what was flown and what was not because one of the uses now-a-days is as a monitoring tool and to look at trends over time and to satisfy reporting requirements that are in our [Forest Service] manual. So, at what point did that change in focus, or that additional use of the data come about?

DRB: I don't think there was a point in time – it was rather a slow gradual change.

JLJ: Was that budget driven?

DRB: I assume that it was budget driven. When it started out we said we'd fly when somebody wanted something flown and then somebody else would want something flown and we ended up basically going back and surveying the whole area anyway. So the grand scheme of only flying the west side every other year disappeared rapidly.

JLJ: So would you say that for trend analysis the major outbreaks were captured on the west side?

DRB: I would say that's a fair statement. The major outbreaks were captured on the west side, but there are some years where background and some small stuff was missed. But I think that would be in an odd year.

KWS: Were there any specific examples of reasons the survey was not done for reasons other than budget? For example lack of observers or aircraft?

DRB: Not that I can recall.

KWS: So anything that was dropped was done so because of budget?

DRB: Right.

JLJ: And what happened during the 80s? Things weren't flown, some of the conditions reports weren't done and it seems like the program kind of fell apart in the 80s. Can you talk about that?

DRB: Well there was a period where actually no one was in charge of the survey and we started doing a national report and rather than continue to do the regional pest conditions reports – why do two reports? We'll just use what we provided to the national conditions report to represent the region. Which was probably unfortunate because the regional reports included not only aerial survey data but also other observations of what was going on that may have been picked up by survey and not recorded on the maps or other information picked up by ground surveys.

JLJ: So at the end of the 80s and the early 90s the program seemed to get a little more structure and direction. How did that happen?

DRB: Late 80s was when we were basically coming out of the doldrums. We didn't have people to do a lot of the map work. We had significantly reduced staff. There was one year that I was the only federal aerial surveyor to fly Oregon and Washington. Talk about a busy summer.

JLJ: What was your role in getting this program back on track?

*DRB: Well, let's go back – I think that part of the deterioration of the survey if you will was due to management's lack of interest. Why worry about survey, it will get done. You know – very little management support. And as it slowly deteriorated, some clients said, "*We aren't getting what we need!*" So we had to encourage management to be more supportive of survey and to give us the resources to get the job done.*

JLJ: And was that happening nationally as well in our region? Or was it just regional at the time?

DRB: I think it was mainly regional at that point.

JLJ: Because there were strong programs in other regions?

DRB: Some regions that had programs and some that did not. R2 for example had a strong program for years, and then it just stopped for a period of years, and then got revitalized when the WO wanted more reporting. Same thing in R5 – CA. There's been a survey program of some kind in NE because of gypsy moth and SE because of southern pine beetle.[239]

1982:

This note about the 1982 survey is from *Pacific Northwest Forest Pest Conditions during* **1983**:

Since most of the timber lands west of the Cascades were not covered during the 1982 aerial survey, the trend of the Douglas-fir beetle in the area is unknown.[240]

1983:

July 1, 1983 Aerial Survey Agreement from FPM Director Paul Buffam to LeRoy Kline, ODF:

The survey will be conducted in the most cost effective and professional manner. This year East side forest lands and portions of West side forest lands as mutually agreed will be surveyed. The survey will take place generally between July and the first part of September.

Background:

A State-wide aerial survey has been conducted jointly by the USDA Forest Service and Oregon Department of Forestry since 1947. All forested lands were to be covered using one survey crew. Two survey crews were started in the late 1960s in order to speed up the survey and get data to landowners quicker. Priorities as to what areas of the State were to be surveyed based upon past and expected damage began in the late 1970s. Priority setting as to what areas in the State are to be surveyed continues in relation to damage and particularly current reduced budgets.[241]

[239]Sprengel, K.W.; Johnson, J.L. 2006. Oral history interview with David R. Bridgwater. August 18, 2006. Portland, OR. R6 aerial survey program files. Sandy, OR.

[240]USFS: ODF; WDNR; ODA. 1983. Pacific Northwest forest pest conditions during 1983. Portland, OR; Salem, OR; Olympia, WA; Salem, OR. p. 15.

[241]Hardcopy, R6 aerial survey program files. Sandy, OR.

1984:

Figure 120. *Iral Ragenovich (USFS). USFS R6 Aerial Survey Program Collection.*

Figure 121. *Jerry Beatty and Iral Ragenovich with 337 survey plane in Flagstaff, AZ. August 1980. Photo by Duncan Kearns (pilot), courtesy Iral Ragenovich.*

Iral Ragenovich (Figure 120) first flew surveys with the Forest Service out of Pineville, Louisiana 1975-1976; Asheville, North Carolina from 1976-1979; and then Albuquerque, NM from 1979-1984 (Figure 121). In 1984 she transferred to the R6 USDA Forest Service Regional Office in Portland and surveyed off and on from 1984-1994. When she arrived, Bob Dolph was the supervisory entomologist; the primary Forest Service surveyors were David Bridgwater, Tim McConnell, and Les Hoyle. When Bob Dolph retired in January 1986, Iral was promoted to supervisory entomologist later in 1986 and supervised the survey program until 1994. Iral has represented, supported, and been an advocate for the survey program and its functional and developmental requirements for over 30 years. As the regional entomologist, she currently manages the survey agreements and funding with the states. During every office move, she ensured that the space-needs for the specialized equipment required for the survey flight maps, map-production, and data automation in the Regional Office were properly planned and executed.[242]

Iral said this about her survey-related work:

> *I think my greatest contributions to aerial survey were that Harold [Thistle], Jack [Barry], and I provided the catalyst that initiated the work on development of the digital sketch mapping, and that Max [Ollieu] and I were persuasive in getting a national aviation safety specialist position for Forest Health Protection established.*[243]

Dave Overhulser worked for Weyerhaeuser from 1977-1984 as a project leader, and was then hired by the Oregon State Department of Forestry as their principal entomologist in 1984. He surveyed from 1987-2005 and flew about 60 hours/year. Because Mike McWilliams was hired late in 1995, Dave Overhulser and Honk Meyer were the first surveyors to fly the Oregon Swiss Needle Cast survey. Dave said the most important aerial survey program improvements during his career included: 1) increased safety from use of a multi-engine aircraft; 2) increased safety from automated flight-following; 3) improved data accuracy with computerized mapping; 4) digital access to data; 5) increased ground-checking of causal agents. (ODF makes 3-5 special surveys/year and all of them have to be ground-checked.)[244]

[242]Personal communication with Iral Ragenovich, April 12, 2016.

[243]Personal communication with Iral Ragenovich, June 10, 2016.

[244]Personal communication with Dave Overhulser, March 10, 2016.

This newspaper article by Tom Hoffman appeared in the La Grande Observer; it includes Paul Joseph (entomologist, ODF); Tim McConnell (aerial surveyor, USFS), pilot Jack Prukop (ODF), and supervisory entomologist Bob Dolph (USFS):

> *Sighting insect infestations in forests from a height of 1,000 feet may sound a bit like looking for the proverbial needle in a haystack. But after 12 years of locating and mapping areas of bug-damaged forests from an airplane, Paul Joseph, entomologist with the state Department of Forestry in La Grande can survey 75,000-100,000 acres in a little more than two hours.*
>
> *Not alone of course.*
>
> *Joseph's partner in the annual aerial insect detection survey is Tim McConnell, of the U.S. Forest Service in Portland. The two have more than 20 years of flying experience between them.* "I think it's a good example of the state and U.S. Forest Service departments working together," *said McConnell.*
>
> *The first aerial survey was undertaken in 1947 when pilots and planes became plentiful after World War II to make aerial surveys both realistic and affordable.*
>
> *Joseph says that the cost today is about a half cent per acre, cheaper than any other alternative, including satellite pictures. Aerial surveys are now taking place in every state, and always through a cooperative effort between federal and state forestry.*
>
> *According to Joseph, the surveys identify* "areas . . . where there are insect problems. Where there are dead trees a salvage sale can be planned if (the trees are) accessible."
>
> *The surveys also identify insect population trends and may spur control projects to ease forest damage. Joseph and McConnell usually start by 10 a.m. and end about 3 p.m., taking advantage of the best daylight hours. In the seven seat, twin engine plane piloted by Jack Prukop, the three forest agency employees work as a team.*
>
> *Joseph and McConnell take turns working from the front seat. Although visibility is greater there, so is the responsibility, since that person must keep the pilot on line over the survey area.*
>
> *The front seat passenger must also map two miles of insect damage extending from the aircraft's right side.*
>
> *The other passenger, mapping from a rear seat, covers the two miles on the pilot's side. Travelling at an average speed of 110 mph and at an altitude of 1,000 feet above the terrain, Joseph and McConnell can cover four miles in one pass. And by using east-west flight lines, the two can map the northern portion of the Wallowa-Whitman National Forest, excluding the Eagle Cap Wilderness area, to a spot as far south as Lookout Mountain in a little more than two hours.*
>
> "You need a good pilot with experience to do this job properly," *Joseph said.* "When you rent a plane, you spend more time keeping the pilot on line than doing your job."
>
> *Wearing red-tinted sunglasses will make it easier to see the slight change in hue caused by insect infestations, Joseph and McConnell discuss their findings over headsets.*
>
> *Both use two different colored pens to mark their [paper] maps – red for the mountain pine beetle and blue for the Western spruce budworm.*
>
> *The area mapped for the pine beetle, which mainly attacks lodgepole pine, is drawn using red circles, indicating the small areas the insect has infested [caused tree mortality]. The mountain pine beetle's latest major outbreak was first detected in 1967 in the Fly Creek area about eight miles south of Starkey, said Bob Dolph of the U.S. Forest Service's Regional Office in Portland.*
>
> "The lodgepole (mountain pine) beetle has pretty well run its course in the country," *said Joseph as the flight ended.* "The budworm is the main problem now."
>
> *Indeed, the first local sighting of budworm, which attacks all fir types, was near Cove in 1980. Now, the budworm is so prevalent in the region that blue pen marks simply indicate the pest's outer boundaries.*
>
> "The spruce budworm is most difficult to map near Cove – there is so much to map that you're mapping all the time," *Joseph said.*
>
> *After the eight weeks of mapping Oregon have passed, records are sent to Portland and entered on a computer. Late in the fall, results are sent back indicating how many acres are involved, which insects were sighted and how much timber was damaged.*

"It's good trend data," *said Joseph.* "It's nice to know what you've got, and where your problems are." *Besides yielding data for control and salvage projects, Joseph said the survey helps him advise landowners on types of trees not to plant. Unfortunately, the information has a down side too.*

"We're losing more trees to insect damage every year than to anything else," *Joseph said.*[245]

1985:

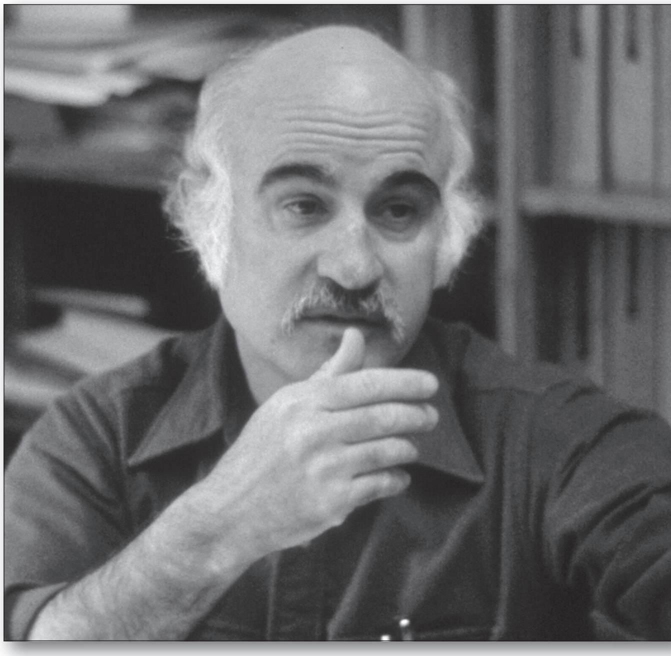


Figure 122. *Rick Johnsey, entomologist and aerial observer for WDNR 1971-1992. USFS R6 Aerial Survey Program Collection.*

Alan Kanaskie was hired by ODF as their Principal Pathologist in January 1985.

1986:

Figure 123. *Paul Joseph ODF (left), Tim McConnell (USFS), and Dave Swan (pilot and Partenavia sales representative) during a lunch break with the ODF Partenavia. USFS R6 Aerial Survey Program Collection.*

[245]Hoffman, T. 1984. The Observer Newspaper. La Grande, OR. Wednesday 29, 1984. p. 3

ODF purchased a Partenavia P68 Observer Aircraft N9000V (Figure 123) for use as a survey aircraft by the state of Oregon. This twin engine high wing plane with a plastic nose increased visibility and made surveys much easier.[246]

Bob Dolph retired January 31, 1986.

1987:

Figure 124. *ODF pilots Jack Prukop (left) and Jim Baranek (right). USFS R6 Aerial Survey Program Collection.*

Jim Kinney resigned the pilot position and Jim Baranek (Figure 124) was hired as full-time ODF pilot.[247]

February 1987: Prior to leaving FPM to take a temporary appointment in Corvallis with John Teply and Eric Twombly (USFS Timber), Tim McConnell wrote the *Region Six Forest Pest Management Annual Aerial Insect Detection Survey Map Processing Handboo*k (See McConnell 1987) to ensure that the complex map and data processing would continue as it should. From his introduction to the handbook:

> *This handbook has been created to help those helping Forest Pest Management process and complete the Annual Aerial Survey tasks. Knowing full well the size and complexity of the survey process from beginning to end, I hope this will lessen some of the problems, wasted time, and errors often associated with getting the survey maps and data out to our customers This handbook is by no means complete but it'll help.*
> *Tim McConnell*
> *Aerial Survey Forestry Technician*
> *1979 to 1987*[248]

Fortunately when Bill Ciesla came to R6 in 1988 as the new FPM Director, he offered Tim a permanent position … and proper map and data processing indeed continued.

[246]ODF. 2014. A chronology of Oregon's forest insect and disease program with highlights of historical events and emphasis on the Oregon Department of Forestry. Unpublished report compiled by: LeRoy N. Kline; Eugene A. Irwin; Dave Overhulser; et al. Hardcopy, R6 aerial survey program files. Sandy, OR.

[247]Ibid.

[248]McConnell, T.J. 1987. Region six Forest Pest Management annual aerial insect detection survey map processing handbook. Portland, OR: USDA Forest Service, Pacific Northwest Region, Forest Pest Management. Introduction.

1988:

Figure 125. *Former R6 FHP Director Bill Ciesla (left) and pilot Jim Gallaher before a survey of northern CO in 2009. Aircraft N126Z, a Cessna 206 owned by USFS Region 2. In retirement, Bill Ciesla worked as an aerial survey contractor for the Colorado State Forest Service from 2004-2015. Photo by Joe Duda, Colorado State Forest Service; courtesy Bill Ciesla.*

March 1988 - Bill Ciesla (Figure 125) accepted the FPM Director position. (March 1988-June 1990). From Ciesla's 2006 WFIWC *Founders Award Address*:

Portland, OR – 1988-90

…I learned that I had been selected to fill the vacancy of Director of Pest Management in R-6, a position that had been vacant for nearly two years. A major outbreak of western spruce budworm was underway in the Region, with several million acres of forests suffering defoliation. Plans were already underway for a large suppression project and I arrived just in time for Regional Forester Jim Torrence to announce that, based on the Environmental Analysis that had been completed, he would authorize treatment of up to 1 million areas providing they met the pre-spray insect population densities that had been established.

That project took up virtually all of my time for my first six months in R-6. We successfully treated 600,000 acres, all with undiluted formulations of Bacillus thuringiensis. *For the first time, we adapted the Incident Command System (ICS), an organizational structure for managing large wildfire suppression projects, to insect suppression. We established five Incident Command units and an Area Command in Portland. The project involved deployment of over 70 helicopters, a fleet of turbine powered fixed-wing aircraft and over 700 people. I believe it still stands as the largest single western spruce budworm suppression project that involved exclusive use of a biological insecticide. The project was a great success and all of the units treated met the post treatment criteria of < 1 budworm larva/15 inch branch. We conducted smaller western spruce budworm suppression projects in 1989 and 1990.*

…

By the time I arrived in R-6, some of the FPM staff was already involved in the use of the MOSS GIS, which my former unit, MAG, had made available several years earlier. With a little encouragement, in 1989, Tommy Gregg, Kathy Sheehan, Tim McConnell and several others on the FPM staff produced the first R-6 regional insect conditions map generated by a GIS. One of my proudest moments was to display this map at a meeting of the R-6 Leadership Team.[249]

[249]Ciesla, W.M. 2006. Founders award address: Forest Health Protection under a wandering star. WFIWC. http://wfiwc.org/awards/founders-award/speech/ciesla

Meeting notes from a March 17, 1988 safety meeting, called by Bill Ciesla, included a 1987 letter from Les Hoyle, who had been working with FPM for 16 years as a seasonal observer. Meeting attendees: LeRoy Kline, Gene Irwin, Paul Joseph, Jack Prukop, Jim Baranek (all ODF); Bob Backman (WDNR); Iral Ragenovich, Dave Bridgwater, Sara Grove, and Tim McConnell (USFS FPM); and a Fire and Aviation Management (USFS FAM) representative.[250]

From the 1988 *Western Spruce Budworm Management in Oregon and Washington Environmental Impact Statement*:

> **Summary of Prior Events:**
>
> …
>
> *A major western spruce budworm outbreak, encompassing 10 National Forests, BLM, BIA, and adjacent State and privately owned lands, currently exists in the Pacific Northwest Region. Budworm defoliation was first detected during an aerial survey in 1980 when 6,000 acres were mapped in the Mill Creek Drainage near Cove, Oregon. By late summer of 1981, the number of defoliated acres had risen to 300,000. During the summer of 1982, an environmental analysis of the situation led to an insecticide spray project, using carbaryl and acephate on 178, 549 acres in the Umatilla and Malheur National Forests.*
>
> *In August 1982, an aerial detection survey showed the outbreak then covered 1.5 million defoliated acres, which was a substantial increase. Based on another analysis, it was decided to conduct a second control project, this time aerially treating 524, 561 acres with chemical insecticides on the same two Forests during the summer of 1983.*
>
> *The defoliated acreage increased to 2.4 million in 1983, prompting another analysis. A small 850-acre field test of the biological insecticide* Baccillus thuringiensis (B.t.) *was conducted on the Ochoco National Forest. In 1984, defoliation covered 2.9 million acres, prompting another analysis of the situation. Treatment carried out in 1985 was an operational evaluation of several formulations of B.t. on about 40,000 acres. Defoliated acres increased to 3.6 million acres in 1985. In 1985 and 1986, an analysis was again conducted, this time considering only the alternatives of no action and treatment with B.t. No treatment was done in 1986 due to lack of suppression funds. The outbreak increased to 6 million acres in 1987. In 1987, 135,000 acres were treated on the Wenatchee and Malheur National Forests. In 1988, 600,000 acres were treated on the Mt. Hood National Forest, Umatilla National Forest, Warm Springs Indian Reservation, and Umatilla Indian Reservation.*
>
> *In 1988 the need to take a broader look at the outbreak was recognized. The commitment has been made to develop the operational capability needed to prepare management strategies for the complex of insects and diseases.*[251]

Ciesla's 2016 reflections on the aerial survey program:

> *During my time in R-6 I never flew an aerial survey, but once a year Jim Hadfield [head of Operations in the RO] and I would get in an airplane and do a reconnaissance over areas infested by western spruce budworm and areas that were proposed for aerial treatment during the following season. I always looked forward to that.*
>
> *One of the things I have said about the FHP aerial survey program over the years is that the aerial forest health survey is the eyes of our program. Without it, we would be blind.*
>
> *Some of the challenges of forest health surveys and reporting are:*
>
> 1. *Consistency of data between individual observers, survey teams and regions.*
> 2. *Learning aerial signatures.*
> 3. *Being prepared for the unusual.*
> 4. *I detect something I've never seen before almost every year that I fly.*[252]

[250]Hardcopy, R6 aerial survey program files. Sandy, OR.

[251]USDA Forest Service. 1988. Draft Environmental Impact Statement for managing western spruce budworm in OR and WA. Portland, OR: USDA Forest Service, Pacific Northwest Region, States of OR and WA and Portions of CA and ID. Chapter 1 – page 4.

[252]Personal communication with Bill Ciesla, April 27, 2016.

1989:

Figure 126. *Jack Prukop and Dave Overhulser. 1989. Photo courtesy ODF.*

Craig Atchley was hired as a seasonal employee to train as an aerial observer (1989-1991).[253]

From Sprengel's *60 Years of Aerial Survey*:

> *I think 1989 was the first year FPM was considered to have their own aviation officer. Dave Bridgwater made a presentation at an R6 aviation officers' meeting showing that Forest Pest Management had actually flown more hours in 1988 than fire had in R6. Fred Fuchs, the Regional Aviation Officer, designates Dave as the first unit aviation officer for FPM.*[254]

Prior to 1988, Fire and Aviation Management (FAM) had allowed surveyors in R6 hazard pay, because they flew below 500 feet above ground level (AGL) at least once/day.[255] FAM then directed FPM not to fly below 500 feet AGL and the surveyors lost their hazard pay. Tim McConnell and Bill Ciesla pursued hazard pay for aerial surveyors in 1989. In 1990, after Bill left, Iral continued to pursue it on behalf of the surveyors. Approval (in single engine planes only) was granted by FAM in the fall of 1990 (See Appendix 5.2) because of "limited control flights" defined as:

> *Maneuvering single engine aircraft at low levels and low speeds for the purpose of wildfire and natural resource surveys over rough terrain in remote regions of the country. The hazard is possible engine failure or mechanical malfunction that would dictate emergency landing under the worst possible conditions.*

When Tim went to Region 1 in June 1992, he raised the issue nationwide. In 2001, Rob Mangold (National FPM Director) authorized hazard pay for all aerial surveyors, nationwide (see Appendix 5.2).

[253]ODF. 2014. A chronology of Oregon's forest insect and disease program with highlights of historical events and emphasis on the Oregon Department of Forestry. Unpublished report compiled by: LeRoy N. Kline; Eugene A. Irwin; Dave Overhulser; et al. Hardcopy, R6 aerial survey program files. Sandy, OR.

[254]Sprengel, K.W. 2007. 60 years of aerial survey presentation. Portland, OR. R6 aerial survey program files. Sandy, OR.

[255]Because of they flew below 500' AGL, surveyors were required to wear nomex flight suits and gloves … but not helmets! Personal communication with Tim McConnell, April 21, 2016.

1990:

From 1990 WFIWC proceedings, *Regionwide Aerial Surveys* presented by Tim McConnell and Katherine A. Sheehan:

> *The regionwide survey of pest damage in the Pacific Northwest Region is based on aerial sketchmapping. Because there is so much mixed ownership on the forested lands, Washington and Oregon have agreed to do a cooperative annual survey with the Region. Two fixed-wing aircraft are used simultaneously, one in each state. Each year an annual safety meeting is held with all involved personnel. A coordination meeting of observers and pilots is held at this time also.*
>
> *Most Regions do not have depth in their aerial survey cadre. It takes several seasons of aerial survey participation to become proficient. Base maps for sketchmapping are the Forest Series (½ inch: 1 mile) and USGS (1:100,000) topography quad maps. It takes 60-80 hours to prepare [paper] maps for this survey.*
>
> *During the survey two sketchmappers record information for a four mile wide strip, flown at 100 to 110 knots. At the end of a day's flight, they combine their maps into one master map. Ground checking is a vital part of aerial survey. Time pressure to get the survey completed has eliminated all ground checking except by district personnel. Hopefully this will change.*
>
> *Mylar overlays of Forest maps are inked by tracing the master map. Digitizing for GIS is also done from the master map. In 1989 the Region inked 60 mylar maps and distributed these to Ranger Districts, BLM Districts, Indian Reservations, National Parks and the states of Washington and Oregon.*
>
> *The Region used MOSS as their GIS. Digitized map files were imported into MOSS and base maps are produced that show insect damage, land ownership, wilderness areas, state forest districts, county and state boundaries. Maps can be drawn by MOSS at a range of scales on either paper or acetate. Tables can be produced using Paradox (a relational database) to summarize acres, number of trees, and volumes affected by pests. MOSS resides on the Data General and its use must be scheduled with other uses on the system.*
>
> *Aerial survey is a team effort requiring many specialized skills. Deadlines occur throughout the process. Training, documentation, and cooperation are the keys to success. New systems like GIS and Paradox add to the usefulness of the final product.*[256]

From a 1990 WFIWC workshop, *The Application of Geographic Information Systems in Forest Pest Management*:

> *Moderator: Ross Pywell*
> *Panelists: Charles Dull, Bill Ciesla*
>
> *The USDA Forest Service, Forest Pest Management (FPM) staff, in Portland, Oregon, has developed a GIS capability to support the Region's annual aerial detection survey. This capability uses MOSS software which has been officially designated as the interim software for project level GIS application in R-6. … Pest status information, by year, which is acquired from aerial sketchmap surveys, is entered as individual data themes. Three years of pest data are currently in the system. The MOSS software is used to generate statistical reports to meet Regional and National reporting requirements and maps products.*
>
> *The system has also been used to support planning of large insect suppression projects and to display the results of recent western spruce budworm suppression projects. We have succeeded in moving MOSS files from the FPM data base to ARC-INFO systems residing at the Washington Department of Natural Resources and the Bureau of Indian Affairs.*[257]

[256]McConnell, T.; Sheehan, K.A. 1990. Regionwide aerial surveys, In WFIWC proceedings, March 6-8, 1990. Coeur d'Alene, ID. p. 48-49.

[257]Pywell, R.; Ciesla, W.M. 1990. The application of geographic information systems in Forest Pest Management. In WFIWC proceedings, March 6-8, 1990. Coeur d'Alene, ID. p. 60-61.

When Bill Ciesla left to take an assignment with FAO, Max Ollieu was hired as the new R6 FPM Director. Max, an entomologist, also had an aerial survey background. He supported the technological improvements needed to help the program advance, including the initial explorations into digital sketch mapping and automated flight following:

> *My aerial survey experience started in Texas (1965 -1969) while working for the Texas Forest Service where we flew every two weeks from about late March through October to detect southern pine beetle infestations. During my employment with the USDA Forest Service in the California Region (1971 to 1975) I flew aerial surveys over Yosemite National Park as well as Sequoia, Kings Canyon National Park. Also did the same for the western spruce budworm infestation in northeastern California prior to the 1973 aerial spray project on the Modoc National Forest. In the Intermountain Region, I helped backup our regular survey folks occasionally in southern Idaho and along the east slopes of the Sierras from 1976 to 1979.*
>
> *Aerial survey for forest insect and disease impacts to forest resources requires special skills that aren't easy to find in individuals. My interest in focusing on improvements to the approach involved us [R6 FPM] in trying to get from paper maps to electronic versions and real time tracking of aircraft, etc.*
>
> *I really appreciate the USDA Forest Service along with State counterparts for capturing the rich history of forest insect and disease aerial surveys in the western United States. Our 50th year celebration of the forest insect and disease survey was a huge success and this update will add to and bring the program to the present. Thanks to all for helping to realize those efforts.*[258]

1991:

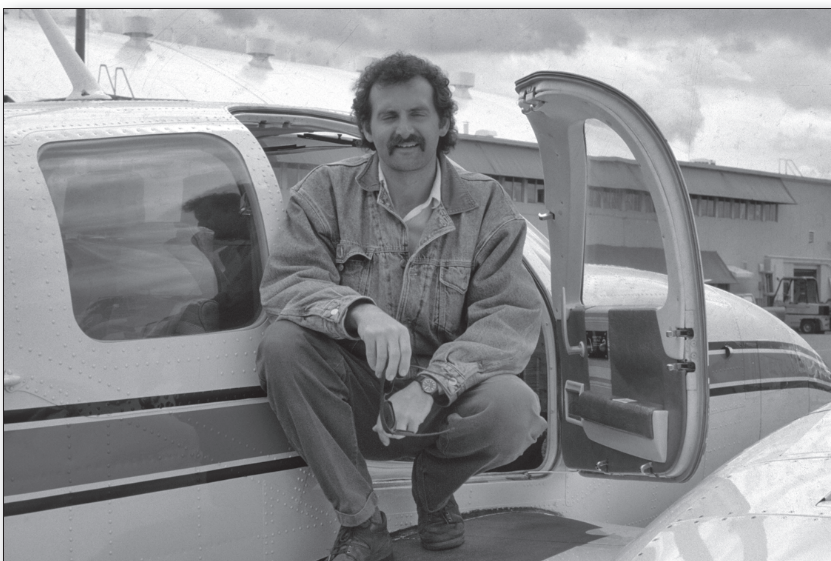


Figure 127. *Keith Sprengel (USFS) with USFS Beechcraft Baron. USFS R6 Aerial Survey Program Collection.*

Keith Sprengel's first exposure to FPM was in 1988 on the big western spruce budworm project, where he worked with Bob Harvey, Beth Willhite, and Bruce Hostetler out of The Dalles, Oregon. Later, he was encouraged to apply for an opening for a full time forestry tech job with FPM and was offered the job in November of 1990. His first two years (1990-1992) he primarily worked on budworm impact plots. In 1991 someone suggested he try his hand at aerial surveying. So he went to La Grande and flew with Tim McConnell and Paul Joseph – and in traditional R6 training style, Keith was told to sit in the back, don't ask questions, and don't miss anything. At the time, Rayburn Mitchell was the seasonal USFS surveyor in Oregon; Les Hoyle (seasonal USFS surveyor) and Bob Backman (WDNR) were surveying in Washington.[259]

[258] Personal communication with Max Ollieu, April 28, 2016.

[259] Personal communication with Keith Sprengel, December 1, 2015.

From 1991 North American Forest Insect Work Conference (NAFIWC) proceedings *Applications of GIS and Forest Pest Models in the Pacific Northwest*:

> *Current applications of GIS include the annual aerial detection survey of forest pests and suppression projects. Sketch maps are digitized and overlaid with several ownership maps. Initial tables produced by the GIS system (MOSS) are imported into a relational database (currently Paradox, probably Oracle in the future). Final maps and tables as well as data files are shared among participating agencies.*[260]

In the summer of 1991, Fay Shon and Tommy Gregg hired Julie Johnson in a new FPM GIS data manager position in the RO. Tim McConnell, Tommy Gregg, and Kathy Sheehan each transferred GIS-related portions of their work to Julie who managed the current-year and historic data automation; maps and geospatial data distribution to customers; and corporate data maintenance and analysis until 2013.

This article featuring LeRoy Kline appeared in the July 6, 1991, Eugene Register Guard:

> **Solutions Sought for Ailing Forests**
>
> *Officials will meet to discuss ways to save forests from a massive insect infestation*
>
> *Vast swaths of Eastern Oregon's forests are dying, the victims of insects that have flourished due to decades of fire suppression, logging of large ponderosa pines, poor soils and drought.*
>
> *In many areas of the Blue Mountains and Wallowa Mountains of northeastern Oregon, the forests are so defoliated that federal, state and timber industry officials are advocating massive intervention to restore them to the condition they were in when settlers first arrived.*
>
> *A two-day symposium next week will explore reasons for the poor health of Eastern Oregon's forests and will seek solutions.*
>
> *Sponsored by the Wallowa County Chamber of Commerce, the Intermountain Forest Health and Resource Symposium will feature experts in pests and forestry and a keynote speech by Dixy Lee Ray, former governor of Washington and author of a recently published book on natural resources.*
>
> *The U.S. Forest Service and several logging, grazing, and farming groups also are sponsoring the symposium, which will be held on July 11 and in Joseph on July 12.*
>
> "It's a crisis," *said Jim McCauley, a forester for the Associated Oregon Loggers in Salem.* "We're running out of time to develop options for treatment … We have the ability to fix some past mistakes, but if we don't do anything, it may take several hundred years before nature gets a handle on this thing."
>
> *LeRoy Kline, director of insect and disease programs for the Oregon Department of Forestry, said a recent state survey indicated that half of the Blue Mountains' forests are "showing visible defoliation from insects."*
>
> *The Oregon Board of Forestry on July 19 will hear a report from Kline about actions needed to restore the forests.*
>
> *The U.S. Forest Service already has examined the issue and is taking remedial action in the Umatilla, Wallowa Whitman and Malheur national forests, said Bill Gast, Wallowa-Whitman deputy forester who headed a study team.*
>
> *The forests have been attacked mainly by the spruce budworm and the tussock moth. Pine beetles also have killed millions of trees across large areas of Central Oregon.*
>
> *Kline attributed the infestations to these factors:*
>
> > *Fire suppression. Fires caused by lightening or set by Indians periodically used to sweep through the Blue and Wallowa mountains, wiping out underbrush and trees susceptible to root rot, infestation and other diseases. The large ponderosa pines, which are not prone to insect damage, usually survived the fires, keeping the forest ecosystem intact.*

[260]Sheehan, K.A. 1992. Applications of GIS and forest pest models in the Pacific Northwest. In 1991 NAFIWC proceedings. March 25-28, 1991 in Denver, CO. D.C. Allen and L.P. Abrahmson, editors. PNW-GTR-294. Pacific Northwest Research Station, Portland, OR. p. 61.

> *Decades of fire-fighting have allowed insect-prone tree species, such as spruce and firs, to thrive and crowd out the pines.*
>
> *Logging. For almost 100 years loggers have selectively cut the towering ponderosa pines and left the less desirable species that are prone to insect damage.*
>
> *Drought. More than five years of drought have allowed insects to thrive.*
>
> *Poor soils. Poor soils put stress on trees and lower their defenses against insects.*

"This thing has compounded itself very quickly," *Kline said.*

Forestry officials fear a major conflagration will erupt, spreading through dead trees and burning hundreds of thousands of acres. Unlike pre-settler fires that burned mainly underbrush while leaving pines intact, a fire rampaging through dead wood likely would destroy everything its path, Kline said.

Federal and state officials say drastic intervention may be needed, rather than allowing the forests to heal themselves. Clear-cutting followed by replanting of ponderosa pines – seldom used practices in northeastern Oregon – may be a way to restore the forests. Controlled fires may be another tactic, Kline said.

Even so, it may take 50 to 100 years to restore the forests, officials said.[261]

1992:

1992 was Keith Sprengel's first year as a trained aerial surveyor. Tim McConnell transferred to R1 that same year as the R1 aerial survey program manager. When Tim left, Keith was tapped to take Tim's place in R6 as the lead surveyor.

Hubert "Honk" Meyer, USFS retiree, was hired as seasonal aerial observer with ODF (1992-1996). Honk already had 25 years' experience as an aerial observer in Montana with US Forest Service.[262]

Rick Johnsey (WDNR) retired after 21 years of survey in 1992.

1993:

In September 1993, Karen Ripley (Figure 132) was hired as the WDNR Forest Entomologist. While her aerial surveying experience was short-lived, Karen was a staunch supporter of the program throughout her tenure with WDNR…until she was hired by R6 FHP in October 2016.

From Sprengel's *50 Years of Aerial Survey*:

> *And I haven't even touched on some of the pilots and people in the Aviation group. In looking at the history of aerial survey it's imperative to recognize the numerous people behind the scenes that have made it the kind of program we can proudly claim over 10,000 hours and 50 years of accident free aviation. People like John Alesco, Cliff Krum, Bob Busch, Bob Sprag and Paul Etchemendy. [R6] also has one of the best aviation groups in the nation with people like Pat Kelly, Bill Bulger, Earl Palmer, Rick Watkins and Clay Hillin to name but a few.*[263]

David Bridgwater assigned Keith Sprengel his first big aerial survey-related job: Create an FPM aviation plan. He did; see Appendix 5.

[261] Robertson, Lance. 1991. Solutions sought for ailing forests. July 6, 1991 Eugene Register Guard. Eugene, OR. p. 1B and 3B.

[262] ODF. 2014. A chronology of Oregon's forest insect and disease program with highlights of historical events and emphasis on the Oregon Department of Forestry. Unpublished report compiled by: LeRoy N. Kline; Eugene A. Irwin; Dave Overhulser; et al. Hardcopy, R6 aerial survey program files. Sandy, OR.

[263] Sprengel, K.W. 1996. 50 years of aerial survey presentation. Portland, OR. R6 aerial survey program files. Sandy, OR.

Figure 127a. *Chris Kliks, (USFS) flew surveys on temporary appointments from the late 1980s through 1993. USFS R6 Aerial Survey Program Collection.*

Chapter 8
The survey moves back to National Forest Systems – 1994-2010

Federal administrative survey responsibility: USDA Forest Service, Pacific Northwest Region, National Forest Systems branch, Natural Resources, Forest Health Protection

Forest Pest Management was renamed Forest Insects and Diseases in 1994, and then was changed to Forest Health Protection (FHP) in 2002; FHP is used for the duration of this document.

1994 brought another administrative move for FHP. At the Regional Office in downtown Portland, FHP and several other Director-level staffs were combined to become one large Natural Resources (NR) staff, under Director Robert Devlin. This move put FHP administratively back in the National Forest Systems branch of the Forest Service – but only in R6.

With the move into NR, FHP Director Max Ollieu's position was renamed 'Group Leader' and the position was downgraded from a 15 to a 14 after Max retired. But within the national FHP community, Ollieu and his successors were still recognized as the R6 FHP Director. Even in NR, FHP's funding still came through the State and Private Forestry branch of the Forest Service.

Around the same time as the RO reorganization, an internal review of the R6 FHP organization resulted in further RO decentralization. Two new technical centers were added in 1994 – one in Sandy, Oregon and the other in Central Point, Oregon:

> *For the last several years [1988-1993] Forest Pest Management (FPM) has been represented in the Region by the FPM staff unit in the Regional Office (RO) and three zone offices. The RO staff consisted of a pathology group, an entomology group, and an operations group. Field offices were the Central Oregon Pest Management Zone located in Bend, OR; the Blue Mountains Pest Management Zone in La Grande, OR; and the Eastern Washington Forest Health Office in Wenatchee, WA.*
>
> *Reviews of the three zone programs were conducted in 1992. Based on these reviews, decentralization was expanded to include the west side of the Cascades, adding two technical centers. The Southwest Oregon Technical Center housed at the J. Herbert Stone Nursery in Central Point, Oregon. The Westside Technical Center first moved to the Columbia Gorge Ranger Station while the Mt. Hood Headquarters were being built. It was then hosted by the Mt. Hood NF in Sandy, OR. Both were staffed in April 1994.*[264]

In 1994 Ellen Michaels Goheen and Don Goheen moved out of the RO to form the Southwest Oregon Technical Center. Jerry Beatty, Bruce Hostetler, Beth Willhite and Keith Sprengel moved out of the RO to form the Westside Technical Center. All three Zones and both Technical Centers were renamed "Service Centers" soon after the 1994 move.

[264]USFS. 1994. Forest insect and disease conditions and forest pest management activities, Pacific Northwest Region, 1993. Gen. Tech. Report. R6-FI&D-TP-11-94. Portland, OR: Forest Insects and Diseases. p. 26 -AND- Sprengel, K. 1995. Forest insect and disease conditions Pacific Northwest Region, 1994. Portland, OR: Gen. Tech. Rep. R6-FI&D-TP-06-95. p. 33-34.

Director Max Ollieu retired in 1997 and Ken Snell filled the position behind Max. For the first time, the Director of Forest Health Protection did not have a forest insect or disease background. Snell's experience included fire management planning, air quality, and fuels. He brought the Air Quality program with him and supervised both Air Quality and Forest Health Protection. Snell left in 2001 for the Deputy Director position in FAM.

With a background in silviculture and budget, Douglas Daoust assumed the acting NR/FHP Group Leader behind Snell on October 21, 2001 and was selected as the FHP Group Leader in September 2002. The Invasives program was also added to his group around this time.

For additional administrative details, see Appendix 2.

1994:

Figure 128. *Cameron Lingle (left) and Keith Sprengel (USFS) - 1995 survey. Photo by Bob Backman (WDNR).*

With all the administrative moves in 1993/1994, David Bridgwater, the regional aerial survey program manager (ASPM), remained in the RO. Keith Sprengel remained the lead aerial surveyor for the region, even after his move to Sandy.

Each of the (now) five service centers and zones were asked to provide an aerial observer in support of the regional survey. These observers included: Roy Magelssen (Wenatchee, WA); Yolanda Barnett (for Bend, OR); Ellen Michaels Goheen (Central Point, OR); Beth Willhite (Sandy, OR); and Suzanne Wiley who flew as-needed throughout the region.

Gene Irwin retired on June 30. Of his 26 years of service to ODF, almost 22 were spent in the Insect and Disease Program in Salem.

Tim McConnell published *Proceedings Aerial Pest Detection and Monitoring Workshop* (McConnell 1995a):

> *The goal of this workshop was,* "To provide a forum for information sharing and technology transfer to people involved in all aspects of aerial insect and disease detection and monitoring surveys." *That goal was met. And from the workshop attendees came the unanimous vociferation for additional training for those people responsible for conducting aerial surveys. Most all Regions share the problem of a diminished cadre of qualified observers and increasing detection and monitoring responsibilities due to increased forest health awareness. No formal training course addressing flight safety and operations has ever been provided to aerial observers or videographers, yet the problem is of national concern. Hopefully, from this workshop, the people responsible for conducting aerial surveys, who need additional or even basic training, will be provided the tools to conduct a safe, efficient and quality aerial detection survey to supply land managers and the public with valuable forest disturbance information.*[265]

[265]McConnell, T.J. 1995. Proceedings aerial pest detection and monitoring workshop, April 26-29, 1994. Report 95-4. Missoula, MT: USDA Forest Service, Northern Region, Forest Pest Management. p. i.

1995:

Figure 129. *David Bridgwater with paper sketch map and pilot Jack Prukop in ODF Partenavia survey plane. 1996. USFS R6 Aerial Survey Program Collection.*

Mike McWilliams was hired as an insect and disease survey specialist with ODF on December 18, 1995. With a background in forestry and forest pathology, Mike had also flown aerial surveys in 1979 in Alaska. In 2000 he completed his Ph.D. in Botany and Plant Pathology.[266]

The first Swiss needle cast aerial survey in Oregon, flown by Dave Overhulser and Honk Meyer, mapped concentrated damage in Tillamook County and scattered lightly damaged stands from Toledo to Astoria. Most damage occurred within 12 miles of the coast.

The Forest Health Technology Enterprise Team (FHTET) was created:

> *The Forest Health Technology Enterprise Team was created by the Deputy Chief for State and Private Forestry in February 1995 to develop and deliver forest health technology services to field personnel in public and private organizations in support of the Forest Service's land ethic, to "promote the sustainability of ecosystems by ensuring their health, diversity, and productivity."*
>
> *The Enterprise Team has two components. The core component, sponsored by Forest Health Protection, supports the Forest Service in meeting its legal mandate for the protection of forest health. The entrepreneurial component builds the team's capacity to fulfill its mission by providing services on a cost-reimbursable basis.*[267]

[266]McWilliams, Michael G. 2000. Port-Orford-cedar and *Phytophthora lateralis*: grafting and heritability of resistance in the host, and variation in the pathogen. Degree: PhD, Botany and Plant Pathology, Oregon State University.

[267]FHTET's home page statement. http://www.fs.fed.us/foresthealth/technology/

1996:

Figure 130. *LeRoy Kline (ODF - left) and Max Ollieu (USFS) at the 50 Years of Aerial Survey celebration. USFS R6 Aerial Survey Program Collection.*

Figure 131. *Gene Irwin (left), Dave Overhulser, LeRoy Kline, and Mike McWilliams (all ODF) at the 50 year celebration. USFS R6 Aerial Survey Program Collection.*

Figure 132. *Max Ollieu (USFS - left), Karen Ripley (WDNR), and Bob Backman (WDNR). USFS R6 Aerial Survey Program Collection.*

Figure 133. *Ken Wright (left) and John Wear at the 1996 50 Years of Aerial Survey celebration in Portland, OR. USFS R6 Aerial Survey Program Collection.*

Prompted by Max Ollieu, a *50 Years of Aerial Survey* celebration was held in Portland, Oregon, in November 1996. Many state cooperators (Figures 130-132) and past surveyors (Figure 133) were able to join in the festivities. The event was hosted by Keith Sprengel. His research and presentations (for both the 50 year and 60 year aerial survey celebrations) laid a solid foundation for this 70 year report.

This marked the final year for Honk Meyer as a seasonal observer (total five years) for ODF. A more extensive aerial SNC survey showed 130,000 acres with disease symptoms all within 15 miles of the coast. A cooperative (ODF, OSU, and private landowners) was formed to coordinate research, funding, and surveys.

From Sprengel's *60 Years of Aerial Survey*:

> *Sometime around 1996, the aviation group was discussing the use of Automated Flight Following (AFF) to improve tracking and safety of aircraft. R6 FHP felt this was an outstanding idea, but were told that significant research was necessary before systems could be selected and put into place. Unable to directly pursue our own investigations, FHP transferred ~$5,000 to our cooperators at ODF. Led by Mike McWilliams, ODF acquired a system through Windstream and we were operational with our own custom flight tracking website by 1998, years before FAM adopted standards and equipment. Today, AFF is required on all agency and contract aircraft as standard equipment.*
>
> *The national Aerial Survey Working Group (ASWG) was formed in November 1996 to provide field level input to the FHP WO staff directors as well as to provide assistance to others conducting or planning to conduct aerial surveys. Representation included, minimally, one representative from each Region, the National ASM, one state representative from each region as well as one FHP Staff Director. The charge of this group is to help ensure that all aerial survey programs are operated in a safe and efficient manner, to acquire high quality data consistent with National Standards, to share expertise, information and ideas and to advise and provide recommendations to the FHP WO Staff directors, State Foresters and State cooperators on AS program issues and opportunities. This group was officially chartered in 2000.*[268]

From a 2006 oral history interview with David Bridgwater (DRB), conducted by Keith Sprengel (KWS), and Julie Johnson (JLJ):

> *DRB: … When I started flying survey, there was no aviation safety for Forest Health Protection or insect and disease management or whatever we want to call ourselves… The first aviation safety training was when I signed myself up to go to an IAMS (Interagency Aviation Management and Safety) course. And that must have been in 1989. It was a fire course. There was a lot of training for fire but it didn't go over to FHP. In fact the aviation community and fire organization barely recognized us. It wasn't until the Regional Aviation Officer Fred Fox – about 1988 - realized we had a significant aviation program and started working with us a little bit. It was around 1996 that Tim and I put together an aviation workshop in Las Vegas and basically the idea was to get all the aerial observers together and look at what we're doing any commonalities – just kind of have an interchange between all the aerial observers. And one of the topics that came up was flight following. And this one person said,* "Well I can't really flight follow because all I have is a King handheld radio." *And we said,* "Does it attach to an outside antenna on the aircraft?" *So we said,* "Why don't you get a hold of the COR [Contracting Officer's Representative] to have them attach an outside antenna?" *He looked at us and asked,* "What's a COR?" *At that point, we realized we knew there were some problems in the FHP aviation community. So Tim and I came back from that and decided that we should put together an aviation safety course for FHP because obviously a lot of people needed some help. So I approached the national aviation safety office and his response was,* "If you think you have an aviation safety problem in your region in FHP then put on your own course." *So Tim and I accepted the challenge, and he, myself, Andy Knapp from R4, and Larry Young who is a BLM OAS (Office of Aircraft Services) got together either face-to-face or by telephone and started to design an aviation safety course designed for FHP around aerial survey. And that became the Aerial Survey Aviation Safety Management (AS2M) and it's still being put on once/year, today. [see Appendix 5.3]*
>
> *KWS: So that started off with the four of you?*
>
> *JLJ: And it's put on nationally?*

[268]Sprengel, K.W. 2007. 60 years of aerial survey presentation. Portland, OR. R6 aerial survey program files. Sandy, OR.

DRB: Yes.

KWS: And it's recognized by Fire and Aviation Management as fully meeting, in excess, all the qualifications under the new interagency aviation training guidelines for fixed wing manager specialist.

DRB: Yes – and by US Department of Interior [USDI] also. That was really the start of it. Shortly after that a letter came out stating that all areas that had aviation programs should have a unit aviation officer officially designated. And since I'd been doing it for a number of years I was grandfathered into that position you might say. Not all of FHP did it immediately but with the change in management in the WO, the new director Rob Mangold, said that all FHP offices will have a UAO … and we do.[269]

Keith Sprengel completed the first R6 FHP Aviation Plan (see Appendix 5).

Figure 134. *Calibration and Conformity training. Standing: Jeff Moore, David Bridewater, Suzanne Wiley, Timothy McConnell, Michael McWilliams, Keith Sprengel, [not identified], Dave Overhulser. Kneeling: Yolanda Barnett, Karen Ripley, and Roy Magelssen. USFS R6 Aerial Survey Program Collection.*

From Sprengel's *50 Years of Aerial Survey*:

Our current survey crew includes me, Dave Bridgwater, Suzanne Wiley, Mike McWilliams, Ellen Goheen, Beth Willhite and trainees: Roy Magelssen and Yolanda Barnett. Stand-ins are diverse and have included Iral Ragenovich, Tom Gregg, Jerry Beatty, Karen Ripley and Dave Overhulser among others.[270]

[269]Sprengel, K.W.; Johnson, J.L. 2006. Oral history interview with David R. Bridgwater. August 18, 2006. Portland, OR. R6 aerial survey program files. Sandy, OR.

[270]Sprengel, K.W. 1996. 50 years of aerial survey presentation. Portland, OR. R6 aerial survey program files. Sandy, OR.

1997:

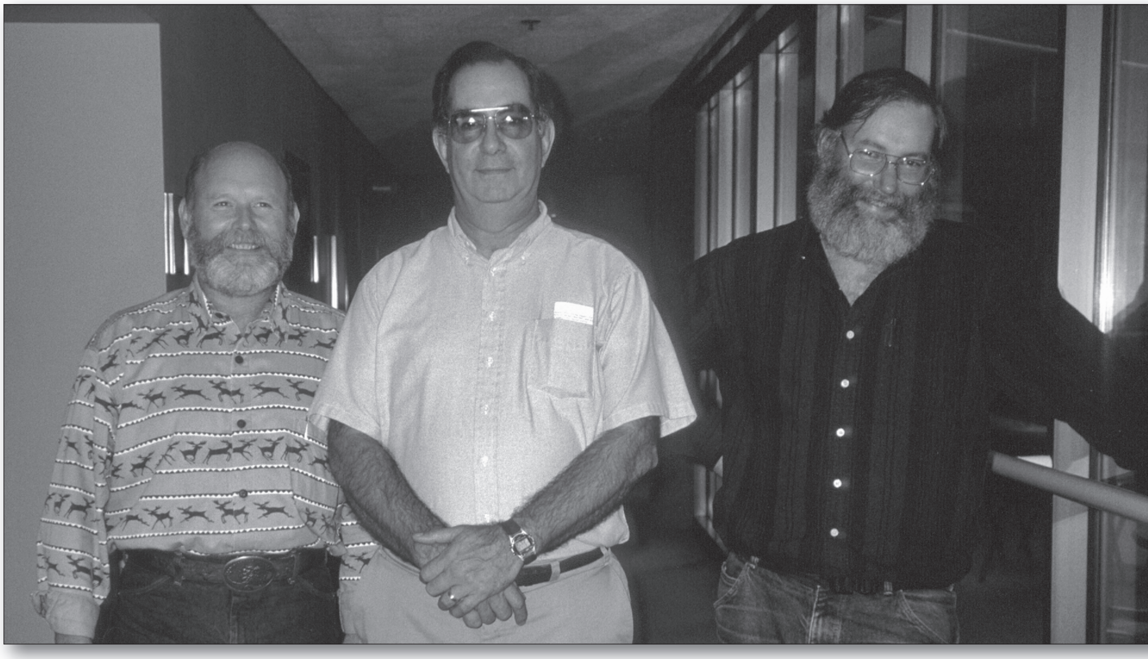


Figure 135. *Tim McConnell (left), David Bridgwater (center), and Mike McWilliams (right) at the 50 years of Aerial Survey celebration in 1996. USFS R6 Aerial Survey Program Collection.*

Automated flight following (AFF) was first tested in an ODF survey aircraft.

Jeff Moore was hired as WDNR aerial survey trainee in 1997; he was the WDNR lead surveyor from 1998-2008.

1998:

Figure 136. *Paul Etchemendy, Washington contract pilot and Partenavia. USFS R6 Aerial Survey Program Collection.*

LeRoy Kline retired Feb. 28, 1998 after 32 years and 7 months with ODF and Jim Mair took over as operations manager behind him.

1999:

Figure 137. *Keith Sprengel (left) (USFS) and Mike McWilliams (ODF) with the ODF Partenavia Observer in Salem airport hangar. USFS R6 Aerial Survey Program Collection.*

From the 1999 pre-season Aerial Survey Review Planning and Safety meeting notes:

> *La Grande Service Center is going to hire a person [Jeff Jenkins] to fly survey for their area this year. Carrie Burns is the new pathology technician and will be helping to fly survey for the State of Washington beginning this year.*
>
> *Observers scheduled to fly this summer: Yolanda Barnett, Ellen Goheen, Roy Magelssen, Mike McWilliams, Jeff Moore, Dave Overhulser, Keith Sprengel, Suzanne Wiley, Beth Willhite.*[271]

A special survey for Swiss needle cast in 1999 was the first operational Insect and Disease survey to use digital sketchmapping in the U.S. Mike McWilliams, ODF survey specialist, played an important role in developing and testing this technology.

2000:

ODF completed a ground verification project of tree damage detected by the special Westside Tree Mortality (bear damage) survey. This was the first time digital sketch mapping was used in an operational survey of tree mortality.

From the 2000 pre-season Aerial Survey Review Planning and Safety meeting notes:

> *Starting in 2000 the Westside Tree Mortality Survey (Bear Damage Survey) was flown as part of the statewide overview insect and disease survey and not as a special survey.*
>
> *Observers scheduled to fly this summer: Yolanda Barnett, Carrie Burns, Ellen Goheen, Jeff Jenkins (Trainee), Roy Magelssen, Mike McWilliams, Rayburn Mitchell, Jeff Moore, Dave Overhulser, Keith Sprengel, Suzanne Wiley, Beth Willhite.*[272]

[271] R6 aerial survey program files. Sandy, OR.

[272] Ibid.

Figure 138. *Calibration and Conformity training 2000. Back row, left: Jeff Moore (WDNR), Jeff Jenkins (USFS), Rayburn Mitchell (USFS), Michael McWilliams (ODF), Keith Sprengel (USFS), Dave Overhulser (ODF); Middle back right: Ellen Goheen (USFS), Yolanda Barnett (USFS), Beth Willhite (USFS); Front left: Carrie Burns (WDNR) and Roy Magelssen (USFS). USFS R6 Aerial Survey Program Collection.*

From a 2006 oral history interview with David Bridgwater (DRB), conducted by Keith Sprengel (KWS) and Julie Johnson:

> *DRB: In 2000 the WO appointed a national [FHP] Aviation Safety Manager.*
>
> *KWS: How did that come about?*
>
> *DRB: Well, there were some people pushing … to get more recognition in the aviation community for FHP nationally. And we suggested that if FHP had an Aviation Safety Manager that FHP might have more recognition. So the directors appointed a subcommittee of three directors and three aerial surveyors to look at that idea and see if it was feasible to have that position. … Tim McConnell was selected for the position.*
>
> *KWS: It's apparent that position has raised the level of recognition of FHP in the aviation community. It's clear from regional aviation safety officer meetings and nationally the participation of that position – just the respect and attention given to us has changed. We had a good relationship in this region before that position, but I've noticed changes and I know from the national working group meetings that other regions have benefitted greatly from that position in advocating safety programs, safety systems, training to assure that people meet the necessary qualifications to perform their jobs.*
>
> *DRB: And actually it's even gone beyond aerial survey, it's informed and developed the Aerial Application Safety Council [chartered in 2009] which comprises FS, state, and industry to address the safety issues of aerial application.*[273]

[273]Sprengel, K.W.; Johnson, J.L. 2006. Oral history interview with David R. Bridgwater. August 18, 2006. Portland, OR. R6 aerial survey program files. Sandy, OR.

2001:

Figure 139. *Douglas Daoust. Photo courtesy Doug Daoust.*

2001 was a big turning point for the R6 aerial survey program. Doug Daoust (Figure 139) filled in behind Ken Snell as the FHP Group Leader – first as acting in 2001 and then permanently in 2002. Doug's unfailingly supportive leadership helped propel the R6 aerial survey program forward, while his background in budget always ensured that funds were available to meet survey obligations. Doug led the FHP staff from 2001 to January 2, 2015. His 2016 reflection on the R6 aerial survey program:

> *During my tenure as the FHP Director I was involved directly with the aerial survey programs in OR, WA, and AK. As part of my involvement I made it a point to be a part of the Aerial Survey Working Group [2006-2014], a national meeting of all the aerial observers around the country. My role was the Director-liaison, representing the aerial survey community to the rest of the directors. I stayed so long because of my passion for the program.*
>
> *It became clear to me through observing and talking with this group of highly trained individuals over the years, that the program we had in the Pacific Northwest was the best program in the nation. I say that not to boast or claim credit, but to acknowledge the fact that the strong technical and professional leadership we have had over the years has made a big difference in the quality of work products produced for our clients. Region 6 was well respected by every Region in the country for the quality of observation and products produced as a result of flying and mapping all forested acres in both Oregon and Washington every year. I am very proud to have been a part of that group of individuals that raised the bar at every opportunity to meet the needs of their clients.*[274]

Figure 140. *Bruce Hostetler. USFS R6 Aerial Survey Program Collection.*

[274]Personal communication with Douglas Daoust, April 28, 2016.

In 2001 Bruce Hostetler (Figure 140) assumed supervision of Keith Sprengel (and, in 2002, Ben Smith) at the Westside Service Center behind Jerry Beatty. Bruce had flown some aerial surveys in Alaska in the mid-70s but didn't fly surveys in R6. He supervised both Keith and Ben until his retirement in 2010 and said this of the experience:

> *I always admired the dedication and skill that the surveyors had, and their ability to get the aerial survey done in the face of many obstacles, including mechanical, physical, and political. I was aware of the inherent risks of the job, and a little uneasy each day they were flying until they reported that they were back on the ground safely.*[275]

To maintain awareness of these 'inherent risks', R6 aerial surveyor supervisors are asked to take A-314 *Aviation Program Overview for FS Agency Administrators* every three years (see Appendix 5.3).

From Sprengel's *60 Years of Aerial Survey*:

> *With challenges in training and maintaining proficiency, especially in the advent of digital sketchmapping, adversely affecting the survey, in a presentation, made to the WO review team in 2001, R6 pitched the idea of returning to a centralized organization with a dedicated core of two observers and a program manager. The review team agreed to the merit of the proposal and authorized the positions. We've been operating as such ever since. Management support at the National and Regional levels has been excellent, allowing the program to explore new and better ways of conducting the annual survey through a strong partnership with FHTET and RSAC.*[276]

From a June 11, 2001, brief prepared by K. Sprengel for an aerial survey program review:

Aerial Survey Today:
Training – We currently require attendance at the Aerial Survey and Aviation Safety Management course with 3-year recurrence. We also require a minimum biannual attendance at our annually conducted Calibration and Conformity session. An apprenticeship program for new observers results in certification upon successful completion.

Safety – we've had 54 accident free years of aerial survey, and an approved aviation plan. Our current [aviation] plan has been revised to incorporate WO review findings and recommendations and is currently awaiting final approval with the Regional Aviation Group.
...
Personnel – We currently have five qualified observers representing the Service Centers, one contract observer, one federal trainee, a program manager and a coordinator/observer. Additionally, the state of Oregon has two qualified observers, and Washington has one qualified observer and one trainee.

Aerial Survey Tomorrow:
Personnel – I recommend we abandon the Service Center conducted surveys and return to two full time observers (federal side) and one manager/coordinator/observer position. This will have several advantages:

- *Flight time would be reduced, eliminating travel and ferry time*
- *Enhanced proficiency – observers would average 6 weeks of survey each year instead of one.*
- *Reduced training costs – fewer people to send to AS2M, and other annually required training sessions. Also, new technology is difficult with short (typically 2 weeks a year) tours of duty.*
- *Safety – trainees on board increase weight and balance challenges, which require more frequent stops for fueling and "pushes" the safety envelope.*
- *Three observers in rotation committed to survey will have one observer available to ground check more often.*
- *Service Centers would still be involved in flights as requested.*

In 2001 the scheduled observers were: Yolanda Barnett, Carrie Burns (trainee), Ellen Goheen, Kreger (trainee), Roy Magelssen, Jeff Moore, Ray Mitchell, Dave Overhulser, Karen Ripley, Keith Sprengel, Stone (trainee), Suzanne Wiley, Beth Willhite.

[275] Personal communication with Bruce Hostetler, April 27, 2016.

[276] Sprengel, K.W. 2007. 60 years of aerial survey presentation. Portland, OR. R6 aerial survey program files. Sandy, OR.

From Sprengel's *60 Years of Aerial Survey*:

> *A new national aerial survey & safety manager position was created at FHTET in Fort Collins through the efforts of Tim McConnell and Dave Bridgwater and supported by the Washington Office. Maybe the position was developed, in part, because of the points Dave made with the RASM back in the late 70's when he asked questions like: "*How come we have to pump down the gear on the 337 every time we land?*" Tim officially filled this position in June 2001 (after serving in that role since 1999) until his retirement in June of 2006. This position was recently filled by Jeff Mai. This position was huge in elevating issues related to FHP training and safety while standardizing many aspects of these programs. Dave and Tim launched the new Aerial Survey and Safety Management (AS2M) course specifically designed to meet the emerging qualifications for fixed-wing manager, special use positions under what will become the Interagency Aviation Training series of qualifications. This training was designed specifically to meet the needs of other resource type flights (i.e. non-fire). (See Appendix 5.)*[277]

From ODF's chronology report:

> *Automated flight following technology was adopted by ODF as the routine method for tracking survey aircraft.*
> *In June, a special aerial survey detected sudden oak death (SOD) (*Phytophthora ramorum*) in tanoak stands near Brookings, in Curry County. The Oregon Department of Agriculture (ODA) established a quarantine zone in Curry Co. ODF participated in a cooperative eradication project in the fall of 2001 to cut and burn all host plants within the nine infected sites. Most of the infected sites were on private land.*[278]

2002:

Jack Prukop, chief pilot (ODF), retired in January, but agreed to return on a seasonal basis to fly aerial survey. Jack supported many improvements to aerial survey and the ODF P-68 Partenavia Observer was used as a test bed for many important new technologies.[279]

After a WO program review in 2001, the first dedicated USFS Oregon and Washington aerial observer positions were created in R6 in 2002.

Robert Schroeter, the first dedicated USFS Oregon lead surveyor was positioned at the J. Herbert Stone Nursery in Central Point, OR, on the Rogue/Siskiyou National Forest. Supervision has been provided by Ellen Michaels Goheen (Figure 140a), 2002-present. Bob's background includes a degree in forestry and work experience on a hot shot crew and forest inventory.

Benjamin Smith, the first dedicated USFS Washington lead surveyor was positioned at the Mt. Hood National Forest Headquarters in Sandy, OR. Supervision was first provided by Bruce Hostetler (2002-2010), and then Beth Willhite (2010-present). Ben's background includes a degree in forestry and work experience in silviculture and public affairs.

Figure 140a. *Ellen Michaels Goheen. USFS R6 Aerial Survey Program Collection.*

[277]Sprengel, K.W. 2007. 60 years of aerial survey presentation. Portland, OR. R6 aerial survey program files. Sandy, OR.

[278]ODF. 2014. A chronology of Oregon's forest insect and disease program with highlights of historical events and emphasis on the Oregon Department of Forestry. Unpublished report compiled by: LeRoy N. Kline; Eugene A. Irwin; Dave Overhulser; et al. Hardcopy, R6 aerial survey program files. Sandy, OR.

[279]Ibid.

2003:

Figure 141. *Calibration and Conformity training, c.2002. Back: Robert Schroeter, Tim McConnell, Ben Smith, David Bridgwater, Michael McWilliams Middle: Beth Willhite, Jeff Moore, Karen Ripley, Suzanne Wiley, Mellanie Kallas, Jack Prukop; Front: Roy Magelssen, Rayburn Mitchell, Keith Sprengel. USFS R6 Aerial Survey Program Collection.*

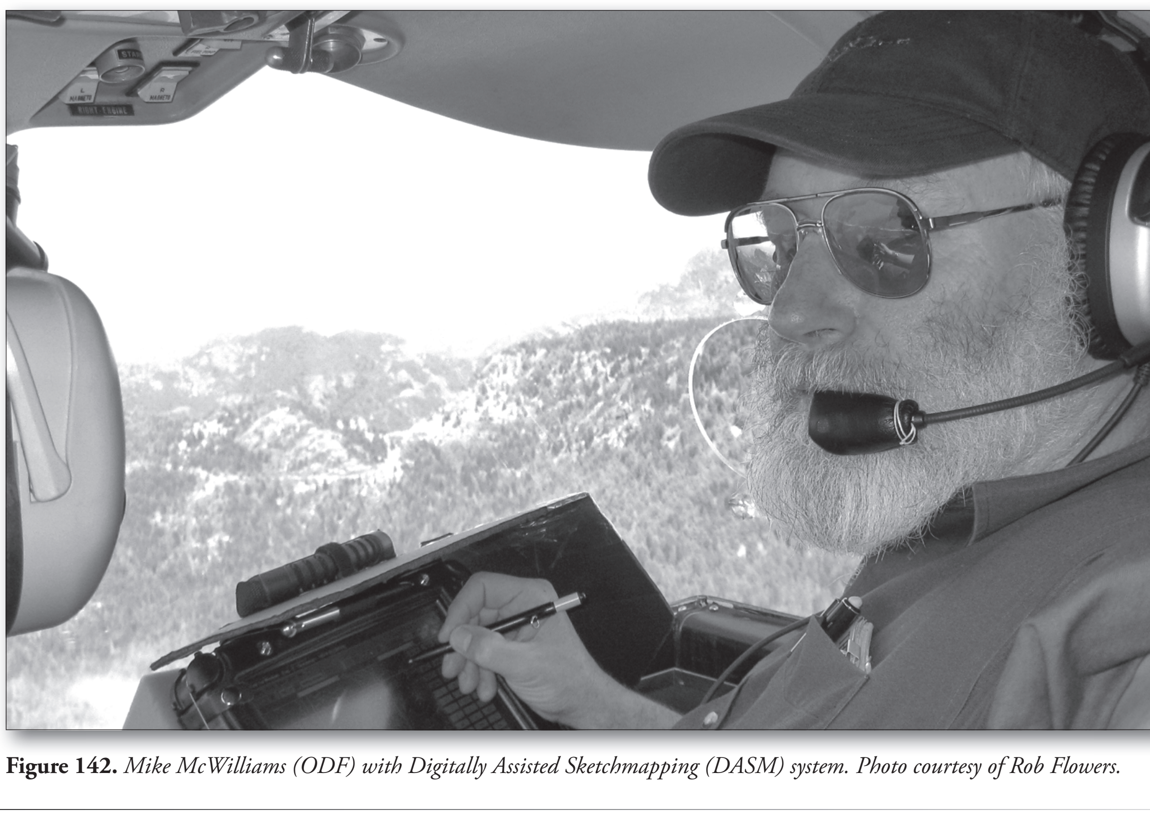


Figure 142. *Mike McWilliams (ODF) with Digitally Assisted Sketchmapping (DASM) system. Photo courtesy of Rob Flowers.*

For the first time, all aerial surveys in Oregon and Washington were flown using a digitally assisted sketchmapping (DASM) system.

This was the first year for a new national aerial survey task book with regional supplements modeled after the Incident Command System (ICS).[280]

2004:

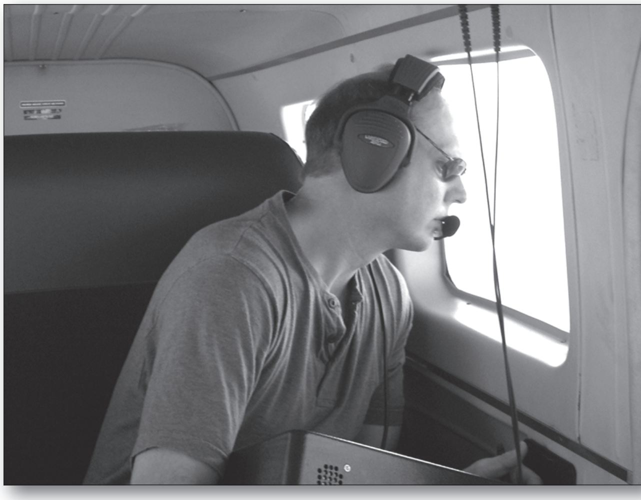


Figure 143. *Jeff Moore (WDNR) with early DASM with KDS screen. Photo courtesy WDNR.*

Chuck McWilliams was hired as a temporary aerial survey pilot (2004-2005) when Jack Prukop did not return. Jim Mair retired and Jim Cathcart took over management of the Insect and Disease section. Sudden Oak Death in Curry County continued to spread despite eradication efforts.[281]

The national Aerial Detection Overview Surveys Futuring Committee report was published (see McConnell and Avila 2004).

2005:

From 2005 WFIWC proceedings, *Detection/Aerial Survey – Methods and Standards*:

> *Moderator – Tim Ebata*
> *Theme - What's New in Aerial Survey Methods?*
> *The workshop was well attended by local contractors and government agency staff involved in aerial surveying. The purpose of the workshop was to provide an update on the most current aerial survey techniques, and in BC's case, to determine if digitally assisted sketch mapping could be applied in the province.*
>
> *Keith Sprengel – USDA Forest Service R-6*
> *Keith described the cooperative aerial overview survey conducted by the USFS/Washington State Dept. of Natural Resources and Oregon State Dept. of Forestry. This region has had a systematic aerial survey since 1949 covering 49 million acres of forest land. As in BC, the survey uses a standard grid pattern or contour/ridge flying. Two observers are on board, each looking out over 2 miles flying at 120 mph. Observations are recorded using the digitally assisted*

[280]Sprengel, K.W. 2003. Aerial survey program presentation. R6 aerial survey program files. Sandy, OR.

[281]ODF. 2014. A chronology of Oregon's forest insect and disease program with highlights of historical events and emphasis on the Oregon Department of Forestry. Unpublished report compiled by: LeRoy N. Kline; Eugene A. Irwin; Dave Overhulser; et al. Hardcopy, R6 aerial survey program files. Sandy, OR.

> *sketchmapping system. Special surveys, such as Swiss needle cast and Sudden Oak Death are conducted as needed, and usually the surveys are designed to capture single agent events. Automated flight following is used to enhance safety and also minimize "cockpit noise and confusion". The survey is supported by regional and national standards for data collection, training, GIS, metadata and safety. Different from BC is that each recorded polygon or point of activity can receive up to 3 separate activity or agent (pest) codes. Each activity code for a polygon receives a modifier indicating the numbers of trees affected or the relative severity of the effect. Up to 82 separate disturbance /host type combinations have been mapped over the last 30 years. The digital mapping system uses scanned 300 dpi 100K USGS maps and the Brovey merged Landsat 7 imagery. The system navigates with Geolink software using accurate GPS data which allows accurate mapping of disturbance polygons, but still relies on the observer's ability to interpret signatures and their relative position while flying at over 100 mph. Future base maps using higher resolution images will be possible when hardware improves. Draft maps are made available in pdf format on the web within a day or two of completing each 30' x 60' quad area. Although positional accuracy of the mapped disturbances has greatly improved, errors continue to be found in identifying the causal agent – a problem inherent to sketch mapping. Maintaining accuracy and consistency is a challenge that can be dealt with by training, maintaining permanent staffing, mentoring, improved technology and more ground checks. Along with the traditional damage reporting and salvage planning uses, numerous non-forest health uses for the data have been ranging from wildlife habitat type identification and fuel loading estimates to input variables for an avian productivity model.*[282]

2006:

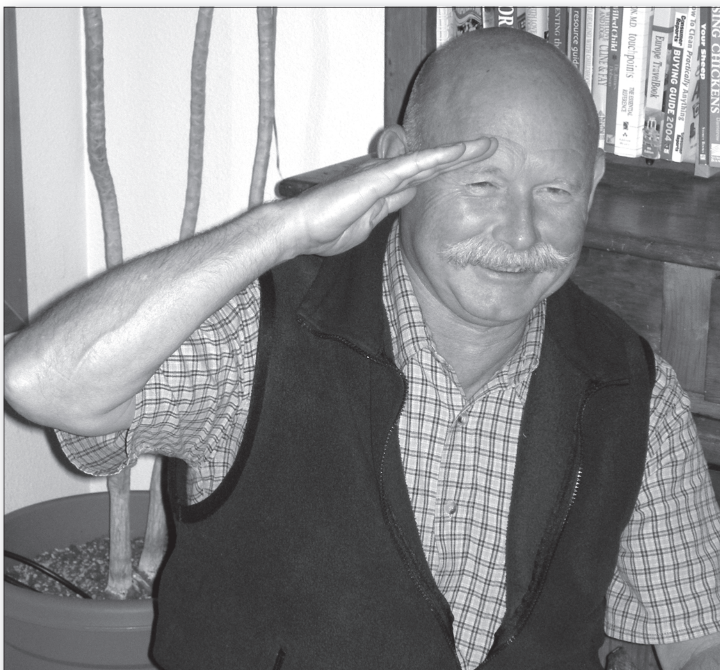


Figure 144. *Tim McConnell at his retirement celebration in June 2006. USFS R6 Aerial Survey Program Collection.*

Tim McConnell retired in June 2006. From his final Aerial Survey Working Group meeting:

> *Tim McConnell noted that as the USFS decreases active management of forests on National Forest lands, aerial surveys that document forest change events from insects, diseases and abiotic causal agents is important to the historical record. Although aerial survey began as a management tool for land managers, recording the history of America's forests is still very important. He encourages all sketchmappers to remember this when times get confusing as to the why and where of doing aerial surveys.*[283]

[282]Sprengel, K.W. 2005. Detection/Aerial Survey – methods and standards In: WFIWC proceedings. March 29-April1, 2005. Victoria, BC. p. 85

[283]Aerial Survey Working Group meeting notes. 2006. 12 p. Hardcopy, R6 aerial survey program files, Sandy, OR.

Jeffrey Mai (ASPM, R5) filled the vacant National Safety Manager position at FHTET behind Tim McConnell later in 2006.

In 2006, in preparation for his retirement in 2008, David Bridgwater passed the regional aerial survey program manager duties to Keith Sprengel. So the ASPM position was moved out of the RO to the Westside Service Center. Keith's supervision continued at the Westside Service Center. The historic R6 aerial survey program files were also moved to Keith's office located at the Mt. Hood National Forest Headquarters.

To document Dave's history with the survey program and its transition, Keith Sprengel (KWS) and Julie Johnson (JLJ) conducted an oral history interview with David Bridgwater (DRB) on August 18, 2006:

JLJ: When did you start with the FS and what is your job history?

DRB: In 1976 I moved out to the regional office in Portland, Oregon and I've been here since.

JLJ: What has been your job title history in this position?

DRB: My official title is still Entomologist. However, currently I am also the invasive species specialist. At other times I have been the remote sensing program manager which includes aerial survey – I did that for 27 years. I was the regional bark beetle specialist from 1985-2003. Unit aviation officer (UAO)– too many years, I don't remember when I started – up until a couple of weeks ago.

JLJ: Up until a couple of weeks ago when you handed the reins over to Keith Sprengel who is also doing this interview?

DRB: Yes.

KWS: Yes. I'm honored. Big shoes to fill!

...

JLJ: You've been the UAO the whole time? So, basically from 1976 forward - ?

DRB: Yes.

JLJ: Are you still the UAO for R6 (laughing)?

DRB: I am no longer the UAO for Region 6 since I have transferred the job to Keith Sprengel. I figure that I might as well get him roped into it now before I retire. I have been training him for the last four years or so.

KWS: Well, in a sense, I feel I have been under training for the last 14 years since I was pointed at in 1992 to do aerial surveys, David has been mentoring me in that school for quite some time.

JLJ: So [Keith] you are now officially our UAO as well as our ASPM?

KWS: Yes, officially.

JLJ: Any other titles you've been bequeathed?

KWS: This interview's about Dave!

JLJ: This interview's also about Dave's transition.

KWS: Well, there's been discussion nationally in the Aerial Survey Working Group and around various regions about what they want in terms of qualifications and position titles for aerial survey program managers within the FHP staff areas. And I think at least many of the people acting in that capacity would like to see them become professional positions at

a higher grade level with the expectation that within the new environment of technology and uses of aerial survey data and the expectation to integrate more information from remote sensing and plot data and to upgrade these positions. We are the first region to have had the management support to evaluate that position and to change it to a biological scientist GS 12 position. Does that answer the question?

JLJ: Yes, that's great!

DRB: Although there was a GS-13 Entomologist doing it before you…

KWS: Yes that's true. There is a lot of variation around the nation.[284]

Chuck McWilliams resigned from the seasonal ODF pilot position and chief pilot Jim Baranek became the aerial survey pilot. Dave Overhulser retired after 22 years and 2 months of service, and Rob Flowers was hired as the new ODF forest entomologist behind Dave.

Amy Ramsey, WDNR forest pathologist, started training as an aerial observer in 2006 and was certified in 2008. She's been on the schedule to fly 2008-2011 and 2013-Present. Her other duties include:

Detecting, studying, and actively researching tree diseases and forest health conditions using aerial and ground methods; identifying biological species; educating, training and assisting the public and managing foresters about forest health and pathology issues and related management strategies; collaborating with personnel from WDNR university, state and federal governmental scientists on various forest health and forest pathology related projects; reviewing, editing and technical transfer of forest pathology related literature and publications; assessing hazard trees in developed landscapes; and investigating wildland fires involving tree failures.[285]

An article in The Spokesman-Review, March 23, 2006:

Beetles creep across the region's forests
By James Hagengruber

The drought seems to be over, but Inland Northwest forests continue to endure lingering insect and disease epidemics prompted by the dry years, according to recent surveys conducted by the U.S. Forest Service and state forest management agencies.

In Montana and North Idaho, forests are experiencing the biggest mountain pine beetle infestation in 20 years, with nearly 1.1 million acres under attack in 2005, compared with 675,000 acres the year before, according to the latest aerial survey.

The Washington Department of Natural Resources also reports mountain pine beetles at "epidemic" levels, with 554,000 acres of forest showing elevated mortality – a 28 percent jump from the previous year.

Most of the infested forest is in northeastern Washington, according to the agency's latest report.

The surveys are conducted annually by low-level, low-speed flights above millions of acres of forest. Information from the reports is monitored by land management agencies and helps the agencies set priorities for forest thinning projects.

Last year's abundant rain and this season's healthy snowpack will help ease the region's drought-stressed forests, said Karen Ripley, entomologist with the Washington DNR. But she said it will take several years of normal moisture for forests to return to health. Even then, Ripley doesn't expect disease and insect levels to abate much.

[284]Sprengel, K.W.; Johnson, J.L. 2006. Oral history interview with David R. Bridgwater. August 18, 2006. Portland, OR. R6 aerial survey program files. Sandy, OR.

[285]Personal communication with Amy Ramsey, March 28, 2016.

The problem, Ripley said, is that forests are becoming a victim of our success in taming wildfires, which once kept forest health problems in check. If fire is kept out of the forest and if logging does not take place, nature has other ways of reducing overcrowding.

"Nature's way is to have some of the beetles kill some of the trees," *Ripley said.* "That relieves some of the competition. … We've got a lot of stressed trees out there now, and they're easy pickings. The dead trees remain, however, and could help fuel "extreme" fire behavior during summer lightning and campfire season."

Lodgepole pine that sprouted after massive wildfires in 1910 are bearing the brunt of the native beetle infestation.
…
In the Colville National Forest, a significant infestation of fir engraver beetles appears to be under way, according the aerial survey. The native beetles have spread through about 368,000 acres in Eastern Washington, a 20 percent jump from the previous year.

In 2002, only 82,000 acres of forest in Eastern Washington were showing elevated signs of mortality from pine beetles, according to the DNR report. Douglas fir beetles also remain prevalent in Eastern Washington, with about 69,000 acres infested, up from 50,000 mapped in 2004.

The species continues to feast on trees killed or stressed by a 1997 ice storm, according to the survey.

Overall, insect and disease problems are showing up in 2.5 million acres of Washington's estimated 21 million acres of forestland, which is up from 1.9 million acres the previous year.[286]

2007:

Figure 145. *Ben Smith (USFS - left), Jeff Moore (WDNR), Bob Schroeter (USFS), Keith Sprengel (USFS), Gary Little (R4 seasonal surveyor), Amy Ramsey (WDNR), Mike McWilliams (ODF) with airport cat, Rob Flowers (ODF), Pilot - Jim Baranak (ODF) with ODF Partenavia Observer. Calibration and Conformity training, Ken Jernstedt Airport, Hood River, Oregon. 2007. USFS R6 Aerial Survey Program Collection.*

[286]Hagengruber, James. 2006. Beetles creep across region's forests. The Spokesman-Review. Available online: http://www.spokesman.com/stories/2006/mar/23/beetles-creep-across-regions-forests/?photos

The *60 Years of Aerial Survey* celebration, hosted by Keith Sprengel, was held at the fall Forest Health Protection Technical meeting, November 7-8, 2007.

From an article Karen Ripley wrote for small woodland owners:

> **Adding Insect and Disease Resistance to Your Woodlands**
> **By Karen Ripley, spring 2007**
>
> *There are three major paths toward adding insect and disease resistance to your woodlands: improving the vigor of the currently growing trees; adding tree diversity to reduce vulnerability to various common insect and disease problems; and improving your ability to recognize important forest insects and diseases conditions.*
> ...
> *Another component of a resistant woodland is the eyes and brains behind the operations, the landowner. Whether you were privileged to study forest entomology or pathology formally or have been picking up bits and pieces of information along the way, it's important to maintain and increase that learning and awareness over time. One of the most useful modern classrooms is the Internet. The USDA Forest Service Region 6 Forest Insect and Diseases website (http://www.fs.usda.gov/main/r6/forest-grasslandhealth/) is a gold mine. It includes pamphlets and articles about major insects and diseases, and provides maps of annual aerial survey results and links to annual state forest health conditions reports. Landowners outside Oregon and Washington can also benefit. Take some time to browse this website, view the maps the specialists create each year showing recently killed or defoliated trees across the states, and renew your acquaintance with some of the other residents of your property, the insects and disease-causing organisms. Your self-study is certain to generate a better "eye" for the pests and conditions that might threaten your land. If it raises questions, contact the local forest entomologist or pathologist for clarification. Forest health professionals and landowners rely on each other for early alert of inset or disease activity, so there will be more options and time for prevention or response.*[287]

2008:

Figure 146. *Calibration and Conformity training 2008. Back row: Daniel Huerta (left) (R5 seasonal surveyor), Zack Heath (USFS R5), Glenn Kohler (WDNR), Ben Smith (USFS), Charlie Schrader-Patton (contractor), Mike McWilliams (ODF), J.D. Mullen (FHTET), Jeff Mai (FHTET), Jim Baranek (ODF pilot), Bob Schroeter (USFS), Trevor Courtney (ODF pilot), Jason Coonta (R5 seasonal surveyor), Kevin Buxton (BC Ministry of Forests); Front row: Rob Flowers (ODF), R5 seasonal surveyor [not identified], Amy Ramsey (WDNR), Jeff Moore (WDNR), Keith Sprengel (USFS). USFS R6 Aerial Survey Program Collection.*

[287] Ripley, K. 2007. Adding insect and disease resistance to your woodlands. 2 p. Online article: http://www.ccffa-oswa.org/NWWoodlands/pests/2007spring-InsectandDiseaseResistance.pdf

David Bridgwater retired from the Forest Service in January 2008.

Jeff Moore, WDNR lead aerial surveyor 1997-2008, accepted an aerial observer position with the USFS R5 program in California working for Zachary Heath.

Mike McWilliams received ODF's Technology Award for his aerial survey work:

Oregon State Department of Forestry Technology Award 2008
Nominee – Mike McWilliams, Forest Health Unit, Private Forests Program

The annual statewide cooperative and special insect and disease aerial surveys are an important tool for gathering information about the status of forest disturbance agents and contribute to the protection, development, enhancement and improvement of the Federal, State and Private forest lands of Oregon. Mike McWilliams (Forest Health Monitoring Specialist, Private Forests Program) has been instrumental in maintaining and improving the 60-year-old statewide aerial survey as the gold standard by which other survey programs compare themselves nationwide. Mike brings the ideal mix of technology and practical field application to the Forest Health Unit in producing high quality, accurate maps of insect and disease patterns statewide. These maps are shared with forestry professionals both internally and externally within the private and academic fields. Maintaining and continually improving this long-term data set provides invaluable information in assessing the scope, duration, and intensity of insect and disease problems in the state. The quality of Mike's work caused the USDA Forest Service to recognize Mike's contributions to the cooperative aerial survey program with a Certificate of Merit in 2007.

One of Mike's strong points is his use of technology to maximize efficiency of data collection and analysis, not to increase gloss and complexity. Each year, Mike spends hundreds of hours in the air and in the field to map insect and disease damage on the 21 million acres of forestland in Oregon, plus approximately another million acres in California and Washington. Special aerial surveys further add to the time Mike spends without his feet on terra ferma. The Department has been able to curtail the spread of and quarantine for the invasive disease Sudden Oak Death (SOD) due to repeated fixed-wing, helicopter, and ground surveys to identify and treat infested sites. Literally every new dead and dying tanoak within Curry County is visited by ODF field crews after being GPS-located by Mike from the air during spring, summer, and fall flights (cumulative 900,000 acres). The speed and efficiency with which these crews can operate is directly influence by the quality of data Mike produces. Other special aerial surveys include the spring flight for Swiss Needle Cast and early summer survey of bear damage covering almost 10 million acres in total.

Mike brings a unique set of skills to the Department's aerial survey program including an extensive knowledge of aircraft types and capabilities, flight planning and safety protocols, and a high degree of skill with Geographic Information System (GIS), Geographic Position System (GPS) and remote sensing tools. This is rounded-out by Mike's strong foundation in forest pathology and traditional field skills, resulting in the seamless integration of aerial survey, GPS, and ground-truthing data to produce high-quality, accurate GIS maps of insect and disease data.

Maintaining and improving upon a nationally recognized aerial survey program goes far beyond the nuts-and-bolts of arranging air, field, and computer time. Mike is called upon to act as a representative of the Department to coordinate and network with other aerial survey professionals. This has ensured up-to-date technology and integration with key cooperators such as the USDA Forest Service in Regions 5 and 6, Oregon Forest Industries Council (OFIC), the Swiss Needle Cast Cooperative, and the California Oak Mortality Taskforce.[288]

2009:

Jim Baranek, ODF survey pilot, retired after 22 years of service in Air Operations. Trevor Courtney was selected as the new Chief Pilot and Will Fisher was hired as a seasonal aerial survey pilot.

Glenn Kohler, WDNR entomologist, has flown some portion of the survey in Washington 2009-Present. He spent one summer as a trainee (trained by Keith Sprengel and Ben Smith) and was certified in 2010. Glenn has flown both the annual overview surveys and some special Swiss needle cast surveys in the state of Washington. His job also includes:

[288]R6 aerial survey program files, Sandy, OR

Forest insect monitoring projects, such as pheromone trapping and plot assessments. Forest defoliator suppression projects, such as Douglas-fir tussock moth and western spruce budworm. Landowner technical assistance with forest insect identification and management. Landowner, state forester, and public forest health outreach and education. Writing outreach publications and publications, posters, and presentations on monitoring project results. Ground checks of aerial survey data.[289]

Figure 147. *Securing overnight accommodations and local transportation between hotel and small airports each night is hit and miss; this transportation was provided by the Omak WDNR for ferrying the survey crew between the airport and hotel in Omak in 2009. Ben Smith (USFS), Amy Ramsey (WDNR), and contract pilot Paul Etchemendy. Photo courtesy of Glenn Kohler.*

Figure 148. *Left to right: Robbie Flowers (ODF), Garrett Meigs (Oregon State University), contract pilot Paul Etchemendy, and Glenn Kohler (WDNR) at the 2010 Calibration and Conformity training in Hood River. Photo courtesy WDNR.*

[289]Personal communication with Glenn Kohler, April 7, 2016.

2010:

Figure 149. *Beth Willhite. Photo by Julie Johnson.*

Aleksandar Dozic was hired as an aerial surveyor and cartographer by the Washington State Department of Natural Resources to fill behind Jeff Moore.

Beth Willhite (Figure 149) assumed supervision of Keith Sprengel and Ben Smith after Bruce Hostetler's retirement. Also in 2010 the aerial survey historic map files and map room equipment were moved out of the RO to the Mt. Hood. The GS-9 technician position was also moved out of the RO to the Westside Service Center to conduct field work in support of the regional aerial survey program.

On June 21, 2010, aerial surveyors, Rodney L. Whiteman and Daniel A. Snider, and pilot Patrick Jessup died in Lock Haven, PA. The US Forest Service issued the following news release:

> **Forest Service Employees in Fatal Plane Crash**
> *Two Forest Service employees and a pilot lose lives in fatal plane crash while conducting aerial surveys.*
>
> **Morgantown, W.Va. June 22, 2010**
> *It is with great sadness that we confirm the names of the Forest Service employees who tragically lost their lives while conducting an aerial pest survey yesterday. The deceased Forest Service employees are Rodney Whiteman and Dan Snider. A contracted pilot was also on board.*
>
> **Rodney Whiteman,** *Forester, was 46 years old and had worked for the Forest Service for 24 years. After graduating from Penn State University, Rod began working for the U.S. Forest Service in 1986 as a Forestry Technician with the Northeast Research Station working on Oak Dominated Forests Research projects. In 1987, he transferred to the Morgantown Field Office, Northeastern Area, State and Private Forestry as a Forester in the Forest Health Protection Group. Over the years, he became an expert in all aspects of the Gypsy moth suppression projects on all federal lands in the Mid-Atlantic States. In addition to his work on the Gypsy moth suppression project, Rod worked extensively as a firefighter and was certified as a Firefighter Type 2, Single-resource Helicopter Manager and Faller B. He served as the Morgantown Field Office Aviation Officer and Trainer. Recently, Rod also served as the Invasive Plant Coordinator working extensively on Tree of Heaven Mitigation projects in Ohio, W.Va., Md., Del., N.J., Pa. and the District of Columbia. He leaves behind wife Megan who resides in Morgantown and a daughter Haley.*

Dan Snider, *Biological Science Technician, was 29 years old and had 9 years of service with the Forest Service. Dan began working for the U.S. Forest Service, Southern Research Station in May 2001 as a student intern Biological Science Technician while attending North Carolina State University-Raleigh. He worked extensively on the Longleaf Restoration Project on the coastal plain of North Carolina. In 2005 Dan transferred to the Northeastern Research Station as a Forestry Technician (Research) in the Disturbance Ecology & Management of Oak-Dominated Forests Research Unit. During this time, Dan responded to Hurricane Katrina as part of a U.S Forest Service Chain Saw Crew assisting with the recovery operations. Dan transferred to his current position in November 2007 as a Biological Science Technician (Forest Pests) with the Morgantown Field Office of the Northeastern Area, State and Private Forestry. Dan worked extensively in the Forest Health Protection Group in cooperation with state partners on Invasive Insect and Pest Detection Surveys in Ohio, W.Va., Md., Del., N.J., Pa. and the District of Columbia.*

His work included pest surveys for Gypsy moth, Hemlock woolly adelgid, Emerald ash borer, and Sirex *wood wasps. He had received extensive training as a Forest Service employee in Geospatial Information, Advanced Firefighting Training and Interagency Incident Business Management and was working on certification as an Aerial Survey Technician. Dan leaves behind wife Elizabeth and son Lee who reside in Pentress, W.Va.*

The two Forest Service employees worked for the Forest Health Program of the Northeastern Area, based out of Morgantown, West Virginia. They were onboard the plane to conduct aerial pest surveys in Pennsylvania.
The National Transportation Safety Board is in charge of the investigation.

"My sincere sympathies to the family, friends and colleagues of these valued employees," *said Kathy Maloney, Northeastern Area Director.* "This is a tragic loss for the Forest Service."

In light of this tragedy, Keith Sprengel sent the following note to the Oregon and Washington observers on July 8, 2010 with a safety reminder to keep a 'sterile cockpit' within five nautical miles (NM) of an airport:

Greetings fellow observers,

As you'll recall from previous communications, we're dedicating our survey season to RodneyWhiteman, Dan Snider and Patrick Jessup. Each week I'll prepare a safety message or topic to honor their memory. It is my hope that a continued focus on safety will prevent such tragedies in the future.

A recurrent theme in my conversations with all of you has been "sterile cockpit". I would like our first safety message to be a review of and recommitment to the principles of sterile cockpit. ... I would like each of us to make a renewed effort to pay extra attention to what is around us and abstain from noncritical activities when we've reached the 5 NM radius limit. I think we can all agree that our eyes are better put to use outside the aircraft in the busy airport environment. Let's make good Sterile Cockpit practice our season-long mission this year and in the years to come. Take the time to point out to fellow crew members when they are engaged in activities that are not directly related to safe flight....and let's be sure and take it in the spirit it's offered.

> *"Sterile cockpit rules apply within a 5-mile radius of the airport. The flight crew will perform no radio or cockpit communication during that time that is not directly related to safe flight of the aircraft from taxi to 5 miles out and from 5 miles out until clearing the active runway. Normally this would consist of reading checklists, communication with Air Traffic Control (ATC), Flight Service Stations, Unicom, or other aircraft with the intent of ensuring separation or complying with ATC requirements. Communications can be accomplished when the audio panels can be isolated and do not interfere with flight operations of the pilot."*[290]

Keith Sprengel
Aerial Survey Program Manager
Forest Health Protection
Pacific Northwest Region
USDA Forest Service

[290]January 2012. Sterile cockpit all aircraft, In: Chapter 16, Aviation Operations and Resources. National Interagency Fire Center. Boise, ID. p. 12.

Chapter 9
The survey moves back to State and Private Forestry – 2011-2016

Federal administrative survey responsibility: USDA Forest Service, Pacific Northwest Region, State and Private Forestry branch, R6/R10 State and Private Forestry staff, R6 Forest Health Protection

In 2011 Forest Health Protection was moved out of NFS/Natural Resources, back to the State and Private Forestry branch of the Forest Service. FHP, along with Cooperative Forestry and Invasive Plants, formed a new R6 State and Private Forestry staff. Doug Daoust's GS-14 position was renamed R6 Assistant Director of State and Private Forestry.

Peg Polichio was hired in April 2011 into a new joint R6/R10 State and Private Forestry GS-15 Director position.

During the summer of 2013, the US Forest Service Regional Office moved from the Robert Duncan Plaza at 333 SW 1st Ave. to the Edith Green Wendell Wyatt Federal Building at 1220 SW 3rd Ave, Portland, OR 97204; R6 State and Private Forestry/FHP staff on the 16th floor.

Peg Polichio retired from the R6/10 SPF Director position June 2014; it was filled in October 2014 by Teresa Raaf.

Doug Daoust retired January 2, 2015 to serve fulltime as the mayor of Troutdale, Oregon.[291] In April 2015, Karl Dalla Rosa replaced Doug as the R6 Assistant Director of State and Private Forestry.

Teresa Raaf retired from the R6/R10 Director position October 2015; it was filled in January 2016 by Debbie Hollen.

For additional administrative details, see Appendix 2.

[291] Doug was first elected in January 2013.

2011:

Figure 150. *Aleksandar Dozic (WDNR). July 27, 2011, with Eagle Flight contract Partenavia N3832Q. Photo by Benjamin Smith.*

From *Forest Health Highlights in Oregon – 2011*:

> *Over 28 million acres were surveyed in the statewide aerial survey in Oregon in 2011. A separate survey of over 2 million acres in western Oregon to document damage from Swiss needle cast (SNC), a foliage disease of Douglas-fir, has been conducted since 1996.*
>
> *Special aerial surveys to detect tanoaks killed by the non-native pathogen, Phytophthora ramorum, the cause of sudden oak death (SOD), have been conducted in Curry County since 2001. Surveys precisely record the location of all dead and dying trees which are then visited by ground crews to assess the cause of tree mortality and sample for the SOD pathogen. In 2011, SOD aerial surveys were conducted in February, May, July, and October covering over 1 million acres in Oregon.*[292]

2012:

On April 26, 2012 the Oregon Department of Forestry and the Washington Department of Fish and Wildlife (WDFW) entered into a three year Interstate Agreement for use of aircraft N357PN, piloted by Marty Kimbrel, to help complete insect and disease aerial surveys in Oregon:

> *Objective: The purpose of this Agreement is to facilitate cooperation, provide cross-training in safety and survey techniques, and accomplish aerial survey missions. This agreement is to the mutual benefit of both parties, and advances the mission and safety of both agencies.*[293]

This state-to-state agreement was the first of its kind in R6.

[292] ODF; USFS. 2012. Forest health highlights in Oregon – 2011. Salem, OR: Oregon State Department of Forestry; Portland, OR: Forest Health Protection.

[293] R6 aerial survey program files, Sandy, OR.

Figure 151. *Bob Schroeter (USFS, Oregon lead surveyor), special ODF Swiss needle cast survey. 2012. Photo courtesy ODF.*

Figure 152. *Kim Reed (left) (FAM) presented Trevor Courtney (ODF), and Keith Sprengel (USFS) with the 2012 Regional Forester's Team Award for Excellence in Safety and Health. Photo by Benjamin Smith.*

2012 Regional Forester's Team Award for Excellence in Safety and Health:

Awarded to: Forest Health Cooperative Aerial Survey Team

Current Team Members:

Trevor Courtney	*Chief Pilot*	*Oregon Department of Forestry*
Aleksandar Dozic	*Observer*	*Washington Department of Natural Resources*
Paul Etchemendy	*Pilot/Owner*	*Eagle Services, Inc.*
Rob Flowers	*Observer*	*Oregon Department of Forestry*
Glenn Kohler	*Observer*	*Washington Department of Natural Resources*
Mike McWilliams	*Observer*	*Oregon Department of Forestry*
Robert Schroeter	*Observer*	*USDA Forest Service*
Ben Smith	*Observer*	*USDA Forest Service*
Keith Sprengel	*Observer*	*USDA Forest Service*

Award Citation: "For excellence in innovative and proactive advancements in aviation safety through open communication and strong interagency teamwork resulting in over 60 years of accident-free cooperative aerial detection surveys."

Award Nomination Narrative

This interagency team of Forest Health aerial detection surveyors is unique in the nation. Since 1949, employees of the USDA Forest Service Forest Health Protection (FHP), Oregon Department of Forestry (ODF) and Washington Department of Natural Resources (WDNR) have jointly conducted aerial detection survey missions. This team conducts missions cooperatively, including mission planning and sharing costs. Surveyors and pilots participate in planning the day-to-day flight operations. As part of the cooperative arrangement, each agency has agreed to abide by the most stringent safety and policy requirements resulting in consistent and highly reliable operations across the Region regardless of State borders.

The Region 6 aerial survey program uses education, innovation, and training to create a culture where safety promotion, risk management, assurance, and policy are integral parts of performing successful missions. By embracing the System Safety model for creating Highly Reliable Organizations this program has created an environment where individuals are valued. A clear vision has always been shared by all: Find new ways of doing the job better and more efficiently while enhancing mission safety. This shared vision has blossomed in an environment of trust, openness and, at times, brutally honest communication. Everyone has a say and their opinions shared, discussed, weighed and democratically considered as to their merit. This has led to many program improvements.

Safety Promotion

The R6 aerial survey program is conducted to maximize efficiency and reduce exposure to risk. To accomplish this goal the team meets several times each year to plan and discuss how best to accomplish this goal. During the spring meeting discussions focus on mission safety, new and emerging technologies, and the programmatic aviation plan. Every other year, in June, the "Calibration and Conformity" session is held to cover aviation safety, mission conduct, testing of new technology and program quality assurance. In the intervening years other safety related trainings are held. In the past we have covered topics such as wilderness medicine and 'Pinch Hitter' courses. This provides the observers with the skills to better deal with emergencies. In the fall the team meets again to learn from the events of the survey season, both positive and negative.

When new observers enter the program, they are provided training to become "Fixed-wing Flight Managers, Special Use". This includes spending one to two years learning the mission from journeyman observers from all participating agencies. The trainee observers must complete a task book designed to meet the operational and safety training requirements of Forest Health aerial surveys in Region 6. Observers who have completed the task book are required to complete refresher training every three years to maintain their currency. Team members have and continue to serve on National Aviation Safety training cadres to ensure that other resource aviation users are well represented.

The team is one of very few in the nation that early on adopted "systems safety" into their aviation planning. They are also one of a very few that have developed a programmatic project aviation safety plan that continues to serve as a model for other Regions. This team strongly encourages the use of the 'Safecom' system to raise awareness of safety issues that will benefit the larger aviation community.

Risk Management

The Region 6 survey program was a leader in adopting the use of Automated Flight Following (AFF), where GPS technology is used to track aircraft. This technology is critical in the event of a crash, reducing response times and reducing the size of the search area. Both are critical in increasing survival rates in the event of a crash. FHP and ODF investigated different AFF systems and were one of the first in the nation to use this system operationally.

The Region 6 Forest Health team in cooperation with the Forest Health Technology Enterprise Team and the Remote Sensing Applications Center led in the development of a new "Digitally Assisted Sketchmapping System (DASM)" driven by GPS. This system allowed us to more accurately record forest disturbance data and cover the Region in fewer flight hours, thereby reducing our overall exposure.

Having experienced the challenges of navigating complex airspace during the annual mission of surveying over 49 million acres of forested lands covering all ownerships, the team immediately recognized possibilities for building in safety enhancements using the DASM system. The team developed a process for acquiring aeronautical sectionals digitally on the flight computers. This allowed observers to have real time information about controlled airspace, restricted areas, congested areas and other potentially hazardous airspace situations. The team also worked with the National office to acquire "digital vertical obstruction files" that they were able to query relative to mission parameters

and load into the flight computers to assist in recognizing and avoiding flight hazards. They also acquired digital runway information and classified it according to "safe" and "safer" runway lengths so wise choices could be made within a second or two in the event of an emergency.

Currently, the team is making excellent progress on an initiative they undertook to evaluate scenarios in situations of engine failures. Everyone, from experienced pilots to relatively new observers has had a hand in development. This GIS-based model evaluates glide and drift down rates in the event of an engine failure. Different models of aircraft are evaluated in different temperature, pressure scenarios at prescribed operating altitudes. The benefit of these models, is that adjustments can be made to the mission parameters to minimize, if not negate, the consequences of an engine out event.

Good crew resource management is practiced by all. Sterile cockpit is observed in congested airport environments with critical communication expressed with professional succinctness. This observant, communicative teamwork has avoided more than one close call in busy airport environments.

The pilots on the team have an excellent attitude regarding safety. They have developed mission specific checklists that exceed FAA requirements and require involvement by the entire flight crew. Their philosophy of education to enhance awareness is evident in their patience and understanding. They are very clear that knowledge and awareness enhance mission safety. On more than one occasion, flights have been postponed or cancelled at economic loss to err on the side of safety. Concern for safety also resulted in the investment of a "Traffic Collision Avoidance System" in one of the aircraft.

Assurance

The importance of the "Safety Communique" (SAFECOM) system is recognized by all and used in the spirit in which it is intended: To share so that others may learn and avoid making the same mistake. There have been several learning examples that would have been easier to walk away from than it was to report. Crew members are encouraged to ask questions and provide input during mission planning and during survey operations.

The Forest Health aviation program in R6 is unique in the agency and the nation. The program in R6 is a good example where a culture has developed that allows individuals from many different agencies to come together as a team, accomplish a survey of all of the forested areas in R6, in a safe and efficient manner.[294]

2013:

Figure 153. *Rob Flowers (ODF), recording forest damage with a digital aerial sketchmapping (DASM) system. Photo courtesy of Wyatt Williams.*

[294]Sprengel, K.W. 2012. R6 aerial survey program files, Sandy, OR.

From *Forest Health Highlights in Oregon – 2013*:

> *Over 28 million acres were surveyed in the statewide aerial survey in 2013. Special surveys were conducted over 2.8 million acres in western Oregon to detect damage from Swiss needle cast, a foliage disease of Douglas-fir, and over 1 million acres in Curry County to detect tanoaks killed by the non-native pathogen,* Phytophthora ramorum, *the cause of sudden oak death.*[295]

2013 marked Mike McWilliams' last year of aerial survey and he flew only the SOD and SNC special surveys. Later in 2013, Mike left ODF to become the new forest pathologist with the USFS Blue Mountains Service Center in La Grande behind retired pathologist Craig Schmitt. Mike's top five program advances during his tenure: 1) Satellite flight following, 2) digital sketch mapping, 3) dedicated federal observers, 4) great map bases for the digital platform thanks to Charlie Schrader-Patton, and 5) *esprit de corps* – the great cooperative working relationships.[296]

Bob Noyes was hired as a temporary aerial surveyor to assist with surveys in Oregon and Washington to cover behind Mike. From an ODF memorandum sent by Rob Flowers and Alan Kanaskie to "Aerial Survey Cooperators", November 4, 2013:

> *This 2013 aerial survey was conducted by ODF Forest Health and Air Operations in cooperation with the USDA Forest Service; thanks to [pilots] Dan McCarron and Wayne Cartright and observers Robert Schroeter and Robert Noyes. Funding for the 2013 survey was provided by the Oregon Forest Industries Council, BLM, ODF State Forests, and the USFS.*[297]

Figure 154. *California surveyors Bob Noyes and Zack Heath, 2014. Both assisted with surveys in R6: Zack in 2006, and later as an R6 employee in 2015 and 2016; Bob in 2013 and 2014. Photo courtesy of Lisa K. Bell, University of California Cooperative Extension, Sonoma County.*

[295]ODF; USFS. 2014. Forest health highlights in Oregon – 2013. Salem, OR: Forest Health Section; Portland, OR: Forest Health Protection.

[296]Personal communication with Mike McWilliams, February 5, 2016.

[297]R6 aerial survey program files. Sandy, OR.

Trevor Courtney left after four years in Air Operations for a position at the Salem Air Center; Dan McCarron was selected as the new ODF Chief Pilot. Wyatt Williams was also hired in 2013 as the ODF Invasive Species Specialist and has been a surveyor-in-training from 2013-2016.

David Bridgwater's March 2, 2013 reflection on aerial surveys:

> *The original aerial surveys were not designed to list all the mortality in the forests. They were designed to identify where there was enough mortality to make salvage logging a commercial possibility. For many years the surveyors were instructed not to map less than five trees per spot. Please remember that in those days there was little to no value in lodgepole or second growth pine.... There have been changes in aerial survey over the years. One hell of a lot of changes, to say nothing about the quality of the surveyors over time.*[298]

Use of normally-aspirated Partenavias for surveys became limited. This summary of the situation was provided by Robert Schroeter, Mike McWilliams, and Ben Smith:

> *Since about the mid-1980s when ODF acquired a normally-aspirated Partenavia Observer, Forest Health aerial surveys in Oregon had been conducted using the ODF Partenavia Observer with ODF and USFS aerial surveyors on board the aircraft.*
>
> *Sometime in the late 1990s the USFS updated agency policy for aircraft performance criteria for multi-engine in the Forest Service Handbook (FSH) 5700. This policy update meant that the ODF Partenavia Observer and the Washington contract Partenavia no longer met the new FS policy horsepower requirements for normally aspirated multi-engine aircraft. The Partenavia Observer engines had 200hp, while the new policy required a minimum of 240hp unless they were turbo/supercharged which would require a minimum of 200hp.*
>
> *The new FS policy did allow for the FS Regional Aviation Officer (RAO) to "grant special approvals for single- and multi-engine airplanes not meeting the requirements for use in that Region under specifically defined conditions" so the R6 RAOs had issued a special approval each year until about 2012.*
>
> *Beginning around 2012 there was increasing reluctance from the R6 Regional Aviation Group (RAG) to continue issuing this special approval, and the terminology "policy waiver" began to be used, even though special approvals were specifically allowed under the policy. RAG's reluctance centered primarily on the fact that FAA's approved single engine service ceiling performance charts for the normally aspirated Partenavia Observer only went up to ~6,900 feet above sea level. Since over half of the Oregon, and about 60% of WA, aerial surveys are flown at altitudes above the Partenavia Observer's FAA approved charted single engine service ceiling, RAG felt that continuing to use the Partenavia for surveys with FS aerial observers on board the aircraft would assume too much risk when flying above the Partenavia Observer's single engine ceiling since it was unknown as to how the aircraft would actually perform in the event of one of the engines failing during flights above the ceiling.*
>
> *After an extended series of meetings and challenging discussions, rather than prohibiting future use of the ODF Partenavia Observer for aerial survey flights with FS aerial observers on board, ODF, USFS FHP, RAG, and the Regional Aviation Officer (RAO) agreed to continue the Special Approval for use of the ODF normally-aspirated Partenavia Observer for aerial surveys within the parameters of the FAA approved single engine service ceiling charts. This effectively allowed the continued ODF/USFS use of the Partenavia Observer for aerial surveys on about 40% of the Oregon cooperative surveys, where the terrain was generally 5,000 feet above sea level or less. The remaining 60% of the Oregon surveys are now completed using other aircraft that meet FS policy, including a USFS FAM Aero Commander and Cessna 206; a US Fish and Wildlife Service Kodiak; and a Washington Department of Fish and Wildlife turbo-charged Partenavia (see Appendix 4.1).*
>
> *In Washington aerial surveys had been conducted for decades with a single, normally-aspirated Partenavia with an exclusive use contract. With the change in the USFS Special Approval policy, the contract could not be renewed for the 2013 survey season. Since 2013, the Washington surveys have been conducted using various combinations of: a USFS FAM Aero Commander and Cessna 206; a call-when-needed Cessna 205; and a Washington Department of Fish and Wildlife turbo-charged Partenavia (see Appendix 4.2).*[299]

[298] Personal communication with David Bridgwater, March 2, 2013.

[299] Shroeter, R.; McWilliams, M.; Smith, B. Summary prepared by R. Schroeter; amended by M. McWilliams and B. Smith, June 2016.

Figure 155. *Keith Sprengel at his retirement celebration. May 1, 2013. Photo by Julie Johnson.*

Keith Sprengel, USFS ASPM 2006-2013 (with FHP from 1990-2013; with the aerial survey program 1992-2013), retired in May. Keith's boundless energy, passion, and desire to improve the R6 survey program moved every aspect of it forward during his 20 year tenure. Keith was pleased with all the operational improvements that occurred during his watch, but most important to him were: 1) strengthening partnerships and interagency cooperation, 2) developing the core program of professional surveyors in 2002, and 3) adopting standards in the areas of safety, data, and training.[300]

May 3, 2013, Keith Sprengel retired. Ben Smith assumed the acting R6 ASPM duties behind Keith.

May 6, 2013, Julie Johnson initiated a detail to Research; contractor, Charlie Schrader-Patton covered duties behind her.

May 7, 2013, David Bridgwater passed away.

David Bridgwater memoriam, 1943-2013:

> *Dave Bridgwater … was an entomologist who had significant depth of experience in a very broad range of western forest entomology situations, and was well known and respected for his expertise in mountain pine beetle and other bark beetles, and for forest defoliators, such as western spruce budworm and Douglas-fir tussock moth. He had a broad experience in all aspects of an aerial application program including contracting, project manager, project entomologist, and aircraft calibration. His knowledge and expertise in aerial detection survey and program management was unsurpassed. He actively worked and, through his persistence, was instrumental in achieving national aerial survey safety standards and quality assurance standards for the aerial detection survey program.*
> …
> *Dave was the ultimate punster and had a wry sense of humor. He was always an active mentor and advisor, and many forest entomologists credit him as one of their most valued mentors. After he retired in January 2008, entomologists continued to solicit his advice, which he freely provided. The compilation of all the knowledge that he shared will never equal the vast sum that was accumulated within the person. He will be truly missed, both within Forest Health Protection, and throughout the forest entomology community.*
> *Prepared by Iral Ragenovich, USFS.*[301]

[300]Personal communication with Keith Sprengel, December 1, 2015.

[301]Ragenovich, I.R. 2013. Dave Bridgwater 1943-2013. WFIWC memoriam. http://wfiwc.org/members/memoriam/dave-bridgwater

2014:

Figure 156. *Ben Smith (USFS – left) with USFS FAM pilot Karl Olson and USFS Aero Commander. Photo by Bob Noyes.*

Figure 157. *Left to right: Rob Flowers (ODF), Bob Schroeter (USFS), Wyatt Williams (ODF), and Glenn Kohler (WDNR) examining beetle galleries during Calibration and Conformity training. June 25, 2014. Photo by Ben Smith.*

In 2014 Rob Flowers left ODF to work with the USFS Forest Health Protection program at the Regional Office in Portland. Danny Norlander was selected to fill behind Mike McWilliams as the ODF NRS 2 Forest Health Survey and Monitoring Specialist in the Forest Health section of the Private Forests Division. A two-year project focused on refining forest health aerial surveyors' estimates of high-intensity tree mortality was initiated in association with Washington DNR and USFS FHP staff.

Ben Smith was promoted to the Aerial Survey Program Manager in the fall of 2014.

Julie Johnson permanently transferred out of the R6 data manager position.

From *Forest Health Highlights in Oregon – 2014*:

> *Aerial surveys using both fixed-wing aircraft and helicopters are conducted each year to assess forest health conditions in Oregon. Surveyors use a digital sketch-mapping computer system, linked to a GPS, and record all visibly affected areas in the form of polygon figures. All figures are coded with the damaging agent(s) based on the surveyor's identification or knowledge of the tree species present. These methods provide for faster data acquisition and improved sharing of survey findings at a lower cost than using other remote-sensing techniques. Over 28 million acres were completed in the annual statewide aerial survey this year.*
>
> *Special surveys were also conducted on over 3.8 million acres in western Oregon to detect damage from Swiss needle cast, a native foliage disease of Douglas-fir, and on over 1 million acres in Curry County to detect tanoaks killed by the non-native pathogen, Phytophthora ramorum-the cause of sudden oak death. These special surveys have been conducted annually since 1996 and 2001, respectively. A new aerial survey of over 300,000 acres mapped gorse (Ulex europaeus), an invasive, non-native weed found in southwest Oregon.*[302]

From a WDNR 2014 report:

> **Aerial Survey.**
> *WDNR has a long history of cooperation with USFS FHP in conducting the annual insect and disease aerial detection survey (ADS). Since 2004, WDNR has trained six observers to conduct the ADS with FHP observers. These observers have participated in most ADS flights every year and have been instrumental in testing, developing, and improving the digital sketchmap systems that have markedly increased ADS data accuracy. Every year, WDNR observers and insect and disease specialists independently conduct ground truth surveys statewide to improve ADS data. WDNR independently conducted a special aerial survey of windstorm damage in western Washington in 2008. WDNR cooperated with FHP to complete a special Swiss needle cast aerial survey in western Washington as part of a Forest Health Monitoring project in 2012. WDNR observers and specialists produce the annual Forest Health Highlights (FHH) report, which is the primary summary of ADS and other monitoring data for federal, tribal, state, and private land managers. The content of the FHH report has been enhanced and increased in breadth in recent years. In 2012, WDNR produced a promotional video about ADS that was used for client outreach. … The primary WDNR observer since 2010 [Aleksander Dozik] has created new or improved ADS data products that are user-friendly and accessible for our clients. These include the cumulative mortality and cumulative defoliation products in our agency data toolbox which are easy to use and interpret. He also promoted the use of supplemental oxygen by observers at high altitude, which has improved observer vision and concentration [see Appendix 5]. He has been the primary liaison between WDNR and the Washington Department of Fish and Wildlife for recent ADS use of their aircraft. With his leadership, WDNR observers were able to independently conduct 30% of the ADS in 2013, due to temporary unavailability of FHP observers. Clear communication with dispatchers is critical to ADS mission safety, so WDNR observers have worked to foster and maintain good relationships with dispatchers by attending their meetings whenever possible.*[303]

From *Forest Health Highlights in Washington – 2014*:

> *The annual insect and disease aerial detection survey (ADS) in Washington was conducted by the USDA Forest Service (USFS) in cooperation with WDNR. The survey is flown at 90-150 mph at approximately 1,500 feet above ground level.*

[302]ODF; USFS. 2015. Forest health highlights in Oregon – 2014. Salem, OR: Forest Health Section; Portland, OR: Forest Health Protection.

[303]Ripley, K. 2014. WDNR. Hardcopy, R6 aerial survey program files, Sandy, OR.

Two observers (one on each side of the airplane) look out over a two-mile swath of forestland and mark on a digital sketchmapping computer any recently killed or defoliated trees. They then code the agent that likely caused the damage (inferred from the size and species of trees and the pattern or "signature" of the damage) and the number of trees affected. Photos are rarely taken. It is very challenging to accurately identify and record damage observations at this large scale. Mistakes occur. Sometimes the wrong pest is identified. Sometimes the mark on the map is off target. Sometimes damage is missed. Our goal is to correctly identify and accurately map within ¼ mile of the actual location at least 70% of the time. In areas with heavy mortality, on-ground measurements of trees per acre (TPA) killed are commonly 2-3 times greater than estimates made from the air.

…

There are several factors that directly influence the way aerial survey is conducted and the quality of resulting survey products. Among them are type of aircraft, crew experience, weather and visibility conditions, time of the year damage signatures are most visible, and temporary flight restriction (TFR) areas. In 2014, aerial survey crews did not have much control over several of these factors. An exceptionally busy wildfire season, including the largest wildfire in state history, required the maximum effort from state and federal aviation resources. In one period there were more than a dozen TFRs which prevented survey crews from flying in areas of eastern Washington. The primary aircraft DNR planned to use was out for the season for maintenance. In spite of all these challenges, the moment the air was clear (early September) and aviation resources were again available, the survey was resumed doubling our efforts with two aircraft and two crews. In most years 75% of survey is done in August when damage signatures are most visible from the air. Surveyors flew only three days (14% of the area) in August 2014. Most of the survey was flown in the first half of September, at end of the optimal window for mapping some defoliation signatures, meaning some defoliation damage was probably underestimated.[304]

Figure 158. *Ben Smith (left) receiving the 2014 National Safety Award from Jeff Mai. USFS photo.*

Figure 158a. *Brent Oblinger, forest pathologist with the Central Oregon Service Area and former aerial surveyor from R5, assisted with R6 surveys in 2013 and 2015. Photo courtesy Brent Oblinger.*

Ben Smith, *acting Unit Aviation Officer, Pacific Northwest Region has been a strong supporter of the cooperative efforts between the USFS, Oregon Department of Forestry and Washington State Department of Natural Resources in the successful and safe execution of forest health aerial detection survey programs for over a decade. Ben continually places safety as the highest priority, promoting Safety Management Systems. He is passionate about all aspects of forest health and forest health aviation, has taken his expertise to the classroom as a qualified Interagency Aviation Training instructor at Fire and Aviation Management-sponsored events and annually at Aerial Survey Aviation Safety and Management for over five years. He is a member of the Aerial Survey Working Group and volunteers for special assignments such as addressing forest conditions issues nationally through the Survey Requirements Team and developing fresh, new training curriculum.*[305]

[304]WDNR; USDA FS. 2015. Forest health highlights in Washington – 2014. Olympia, WA: Forest Health Program; Portland, OR: Forest Health Protection. p. 6-7.

[305]Forest Health Protection Aviation Program. http://www.fs.fed.us/foresthealth/aviation/news.shtml

2015:

ODF hired Christine Buhl (Figure 161) to replace Robbie Flowers. In addition to assisting with surveys, her job description includes:

> *On-site and remote training and technical assistance for landowners and technical experts with ODF, USFS, BLM, OSU extension, etc. on insect-related forest health issues. Collection and dispersal of insect damage data on public and private forest lands in Oregon.*[306]

Zachary Heath, R5 Aerial Survey Program Manager, accepted a lateral into the R6 data analyst/information specialist job vacated by Julie Johnson, effective Feb. 2015. Since all the historic data had been automated, standardized, and loaded into the USFS corporate database. Julie wanted an aerial surveyor with an intimate knowledge of aerial survey data (as well as data analysis skills!) to pull 'the stories' out of the historic data; Doug Daoust made this happen as one of his final acts before retirement. Zack also helped conduct the 2015 overview survey and assisted with the 2016 Swiss needle cast and overview surveys in Oregon. Zack's supervision is out of the RO (Karl Dalla Rosa), but his primary office is located at the Mt. Hood NF in Sandy, Oregon.

August 2015 - Justin Hof, an aerial surveyor from Colorado with a B.S. in Natural Resource Management from the University of Montana, was hired as the USFS Washington lead observer. He was not able to fly during the 2015 season because, in August, all federal travel was shut down, due to a lack of travel funds caused by fire borrowing. With the new three-way Master Challenge Cost Share Agreement (see Appendix 4), WDNR and ODF employees were able to survey together to cover for the sidelined federal employees and complete the survey during the required biological timeframe. Justin's office is located at the Mt. Hood NF, with supervision provided by Ben Smith at the Westside Service Center.

Figure 159. *Danny Norlander (right) (ODF) flew with Glenn Kohler (WDNR) to cover for sidelined federal aerial observers. ODF Partenavia Observer N9000V with pilot Dan McCarron. August 2015. Photo by Glenn Kohler.*

[306]Personal communication with Christine Buhl, March 29, 2016.

Figure 160. *Glenn Kohler (WDNR) in the ODF Partenvia Observer N9000V. August 2015. Photo by Danny Norlander.*

Figure 161. *Christine Buhl (ODF). August 2015. Photo courtesy of Christine Buhl.*

Figure 162. *Wyatt Williams (ODF) invasive plant specialist and aerial survey trainee. Photo courtesy of Rob Flowers.*

2016:

Figure 163. *Justin Hof (left) and Bob Schroeter (both USFS) with the ODF Partenavia in Salem, OR. Special Swiss Needle Cast survey. May 2016. Photo by Zack Heath.*

Bob Schroeter's summary of the digital mapping enhancements he's experienced since 2002:

> *We kept refining and updating the electronic data collection by constantly updating the Geolink projects and data layers we used for the data collection to make it more useful/easier to use and including more layers to display for data collection and aviation safety (like Temporary Flight Restrictions, sectional maps, Digital Vertical Obstruction files, dispatch boundaries, repeater locations, airspace around major airports or military installations, etc.). Also we consolidated the electronic projects over the years as the sketchmapping computers got more powerful, with more hard drive space for data and imagery layers. Initially the projects were the same as/based on the old paper map groups, but as time went forward, the digital systems have allowed us to combine and refine the mapping groups to make them more efficient to use. We created survey boundary file layers to display where the survey is typically flown. We created and used digital flight grid layers that cover the whole state. Also digital flight grids were created for alternate years that were offset from the previous year so as to better cover the survey terrain so that there was less chance that areas or holes in the grid would be missed year to year.*[307]

When Zack Heath, R5 ASPM, transferred to R6 in 2015 to fill behind Julie Johnson, his vacant R5 ASPM position was filled by Jeff Moore in 2016. Following are excerpts from an article about Jeff's current role in R5:

> **Aerial survey program critical to battling tree mortality**
> **By John C. Heil III**
>
> *VALLEJO, California – With tree mortality rising to an estimated record-high 27.6 million trees in California in 2015, the role of the U.S. Forest Service's aerial survey team is more critical than ever.*
>
> *The U.S. Forest Service began aerial survey detection in the Pacific Northwest Region in the 1950s, with a small program in the Pacific Southwest Region (California) established in the 1990s. A dedicated team was assigned to the Pacific Southwest regional office in the early 2000s when Sudden Oak Death became more prevalent. In addition to detecting the Sudden Oak Death and conifer mortality, aerial survey flights first detected the Gold Spotted Oak Borer infestation in 2004.*

[307]Personal communication with Bob Schroeter, June 7, 2016.

> *Last year, Aerial Survey Program Manager Jeffrey Moore and his team discovered nearly 10 times more dead trees than the previously recorded high of 3.3 million in 2014.*
>
> *Moore's team employs a Cessna 205 aircraft, flying at 120 miles per hour, in a three-mile grid pattern to provide a thorough albeit rapid coverage of the landscape. Inside the cockpit, surveyors make freehand sketches of the forests on touch tablets and cross reference their drawings using GPS measurements to give them a base for an acre of land. A top-down, slanted viewing angle allows surveyors to differentiate between species of trees, using color and texture. With over 150 flights per year from June through September, Moore and his team piece together what they see on the landscape.*
>
> "I like to think of it as doing an annual checkup of forests for the whole state," *said Moore.* "Getting that pulse, reading the vital signs and assessing the severity of ailments and the general health overall."
>
> *Weather and smoke can cause safety and visibility concerns, so it is critical that surveys are conducted when the conditions are ideal. . . .*
>
> "We need direct sun off of the tree canopy," *said Moore, who works out of Davis.* "We're looking at which trees have changed color from green to red or yellow."
>
> *Once back in the office, the data is analyzed and summarized using Geographic Information System software, and cartographic satellite imagery is used for the background. In addition to tree mortality estimates, the aerial survey information is also used for forest planning, to include prioritizing timber harvesting. Additionally, this regional data is incorporated into a national database so specialists across the country are working with the most up-to-date information.*
>
> "There are a lot of theories out there and this helps to check that and potentially reinforce, fine tune or cause us to rethink commonly held concepts," *said Moore.*
>
> *Moore has been involved in this unique career since 1997 when he worked for the Washington Department of Natural Resources. He has 30 years of aviation and military experience, having served in the U.S. Army as a Surface to Air Missiles Technician followed by a career in the Army National Guard in helicopter maintenance.*
>
> *Moore's decades of experience and commitment to aerial survey were instrumental in moving the Forest Service program to a digital format, and he continues to be a driving force in improving the program regionally and nationally.*
>
> "He has a strong dedication to safety and is an integral part of Forest Health Protection's (FHP) National Aviation Safety Program, being one of the few qualified aviation safety instructors within FHP," *said Zack Heath, the former Aerial Survey Program Manager who worked with Moore on several flights.*
>
> *Moore and his crew will begin the 2016 aerial survey of California in June, with the final flight estimated to take place in the fall. An early stand-alone survey for the most impacted areas was planned for early April, but weather caused a cancellation.*[308]

Karen Ripley, (WDNR September 1993-September 2016), was hired by the R6 FHP program as the new Forest Health Monitoring Specialist/Entomologist, with a reporting date of October 2016.

[308]John C. Heil III. 2016. Aerial survey program critical to battling tree mortality. Accessed online: http://www.fs.usda.gov/detailfull/r5/home/?cid=FSEPRD498248&width=full

Summary

Systematic aerial surveys to detect forest insect damage in Oregon and Washington began in 1947. Strongly supported by the Northwest Forest Pest Action Council, and funded by the 1947 Forest Pest Control Act, forest entomologists with the Bureau of Entomology and Plant Quarantine (BEPQ) led federal, state, and industrial private forest land managers to cooperatively conduct aerial surveys of Pacific Northwest forests. Many stakeholders generously contributed pilots, aerial observers, airplanes, and ground-checking personnel and all factions worked together to achieve their common goals. By 1949 all forested lands in both states were being surveyed from the air.

Defoliators and bark beetles were the primary focus of the early surveys. Defoliation maps helped determine outbreaks and establish spray project boundaries, while salvage maps of blowdown and bark beetle damage helped land managers quickly prioritize areas for timber salvage and other ground activities. Over the ensuing decades, the survey's focus gradually expanded to eventually include most aerially-discernable forest damage agents.

In 1953, BEPQ forest entomologists were moved to the Research branch of the US Forest Service (USFS). There they continued to lead the regional aerial survey program and to work cooperatively with the Washington State Department of Natural Resources (WDNR), Oregon State Department of Forestry (ODF), and industrial private landowners.

In the early 1960s, amidst growing concerns about pesticides, USFS aerial survey personnel were moved out of Research and into the Division of Timber Management. By the late 1960s, industry's participation in conducting surveys had waned. Later, the 1978 Cooperative Forestry Assistance Act replaced the 1947 Forest Pest Control Act, the Northwest Forest Pest Action Council dissolved, and full responsibility for planning and executing the annual region-wide survey fell to the small group of ODF, WDNR, and USFS employees.

70 years later, these state and federal surveyors continue to document forest damage on all forested lands in Oregon and Washington for use by land managers throughout the Pacific Northwest. These annual data and maps record current conditions for use by local customers and provide a unique landscape-level 70 year record of Oregon and Washington's historic insect activity and trends. These regional data also feed a national database to help create yearly snapshots of the nation's forest health.

Geospatial data, maps, and reports are tangible products from this long-term collaborative effort. But the most important aspect of the survey's history are the people who made it happen. The program has endured thanks to generations of dedicated surveyors who believe in the mission, sustained cooperative relationships, engaged regional customers, and strong management support.

Appendix 1
Regional and national reports summarizing aerial survey findings 1947-2016

These regional and national reports provide detailed summaries and narratives of activity recorded during aerial surveys in Oregon and Washington. Many excerpts in this report are sourced in those listed in this section. For anyone interested in using the geospatial dataset, further reading is encouraged.

1947:

Buckhorn, W.J. 1947. Second memorandum on the Douglas-fir tussock moth outbreak near Troy, Oregon. 10 p.

Buckhorn, W.J. 1948. Defoliation situation in the fir stands of eastern Oregon and Washington - season of 1947. Bureau of Entomology and Plant Quarantine, Forest Insect Laboratory unpublished report. February 18, 1948. 11 p.

1948:

Furniss, R.L.; Buckhorn, W.J.; Wright, K.H. 1948. The spruce budworm in Oregon and Washington – season of 1948. Report by Bureau of Entomology and Plant Quarantine. November 1, 1948. 12 p.

1949:

Lindsten, A.; Buckhorn, W.J. 1949. Forest insect surveys aerial detection season of 1949. Portland, OR: USDA BEPQ; Salem, OR: OSBF. 21 p. https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev2_024354.pdf

Lindsten, A.; Buckhorn, W.J.; Wear, J.F.; Whiteside, J.M.; Wright, K.H. 1949. Spruce budworm situation in Oregon and Washington – 1949 season. Portland, OR: BEPQ. 19 p.

1950:

OSBF; BEPQ. 1950. Report of forest insect detection surveys in Oregon and Washington Season of 1950. 34 p. https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev2_024728.pdf

1951:

OSBF; BEPQ. 1951. Report of forest insect detection surveys in Oregon and Washington Season of 1951. 35 p. https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev2_024729.pdf

1952:

Greeley, A.W.; Wright, K.H.; Pope, R.B. 1953. Final report on the 1952 blowdown bark beetle survey in the Douglas-fir Region of Oregon and Washington. Portland, OR: USDA, Forest Service, Pacific Northwest Forest and Range Experiment Station and Bureau of Entomology and Plant Quarantine, Portland Forest Insect Laboratory. 30 p.

[No author]. 1952. Operations manual blowdown-bark beetle survey. 27 p.

OSBF; BEPQ. 1952. Report of forest insect detection surveys in Oregon and Washington season of 1952. 36 p. https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev2_024471.pdf

PNFRES. 1953. Annual report 1952. Portland, OR. 59 p.
http://ir.library.oregonstate.edu/xmlui/handle/1957/4030

PNFRES. 1952. Summary statement on the 1952 blowdown-bark-beetle survey in the Douglas-fir region of Oregon and Washington. Portland, Oregon. 12 p.

1953:

OSBF; BEPQ. 1953. Report of forest insect surveys in Oregon and Washington season of 1953. 39 p.
https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev2_024730.pdf

PNFRES. 1954. Annual report – 1953. Portland, OR. 71 p.
https://ir.library.oregonstate.edu/xmlui/handle/1957/4126

1954:

OSBF; PNFRES. 1954. Report of forest insect surveys in Oregon and Washington season of 1954. Portland, OR. 51 p.
https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev2_024127.pdf

PNFRES. 1955. Annual report – 1954. Portland, OR.
https://ir.library.oregonstate.edu/xmlui/handle/1957/4126

1955:

PNFRES. 1955. Report of forest insect surveys in Oregon and Washington season of 1955. Portland, OR. 55 p.
https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev2_024240.pdf

PNFRES. 1956. Annual report – 1955. Portland, OR. 87 p.
https://ir.library.oregonstate.edu/xmlui/handle/1957/4003

Wear, J.F.; Buckhorn, W.J. 1955. Organization and conduct of forest insect aerial surveys in Oregon and Washington. PNFRES, Portland, OR. 46 p.
http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev2_026181.pdf

1956:

PNFRES. 1957. Forest insect conditions in the Pacific Northwest – 1956. Portland, OR. 43 p.
https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev2_024586.pdf

1957:

PNFRES. 1958. Annual report 1957. Portland, OR. 89 p.
http://ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/4027/1957_ocr.pdf

Whiteside, J.M. 1958. Forest insect conditions in the Pacific Northwest during 1957. Portland, OR: PNFRES, Division of Forest Insect Research. 54 p.
https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev2_023980.pdf

1958:

Buckhorn, W.J.; Orr, P.W. 1959. Forest insect conditions in the Pacific Northwest during 1958. Portland, OR: PNFRES. 45 p.
https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev2_024587.pdf

PNFRES. 1959. Annual report 1958. Portland, OR. 101 p.
https://ir.library.oregonstate.edu/xmlui/handle/1957/4005

1959:

Buckhorn, W.J.; Orr, P.W. 1959. Forest insect conditions in the Pacific Northwest during 1959. Portland, OR: PNFRES. 42 p.
https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev2_024355.pdf

PNFRES. 1960. Annual report 1959. Portland, OR. 98 p.

1960:

Buckhorn, W.J.; Orr, P.W. 1961. Forest insect conditions in the Pacific Northwest during 1960. Portland, OR: PNFRES. 45 p.
https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev2_024588.pdf

PNFRES. 1961. Annual report 1960. Portland, OR. 104 p.
https://ir.library.oregonstate.edu/xmlui/handle/1957/4007?show=full

1961:

Buckhorn, W.J.; Orr, P.W. March 1962. Forest insect conditions in the Pacific Northwest during 1961. Portland, OR: Insect and Disease Control Branch, Division of Timber Management, Pacific Northwest Region. 47 p. https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev2_023868.pdf

USFS. [nd]. Forest insect conditions in the United States 1961. Washington, DC: State and Private Forestry. 38 p. http://www.fs.fed.us/foresthealth/publications/ConditionsReport_1961.pdf

1962:

USFS. [nd]. Forest insect conditions in the Pacific Northwest during 1962. Portland, OR: Insect and Disease Control Branch, Division of Timber Management, Pacific Northwest Region. 50 p. https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev2_024731.pdf

USFS. 1963. Forest insect conditions in the United States 1962. Washington, DC: State and Private Forestry. 30 p. http://www.fs.fed.us/foresthealth/publications/ConditionsReport_1962.pdf

1963:

Orr, P.W.; Pettinger, L.F. 1964. Forest insect conditions in the Pacific Northwest during 1963. Portland, OR: Insect and Disease Control Branch, Division of Timber Management, Pacific Northwest Region. 64 p. https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev2_024589.pdf

USFS. 1964. Forest insect conditions in the United States, 1963. Washington, DC: Forest Insect and Disease Surveys. 39 p. http://babel.hathitrust.org/cgi/pt?id=uc1.b3552526;view=1up;seq=6

1964:

Orr, P.W.; Pettinger, L.F.; Dolph, R.E. 1965. Forest insect conditions in the Pacific Northwest during 1964. Portland, OR: Insect and Disease Control Branch, Division of Timber Management, Pacific Northwest Region. 94 p. https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev2_024128.pdf

USFS. 1964. Forest insect conditions in the United States, 1963. Washington, DC: Forest Insect and Disease Surveys. 41 p. http://babel.hathitrust.org/cgi/pt?id=uc1.b3552527;view=1up;seq=5

1965:

Orr, P.W.; Pettinger, L.F.; Dolph, R.E. 1966. Forest insect conditions in the Pacific Northwest during 1965. Portland, OR: Insect and Disease Control Branch, Division of Timber Management, Pacific Northwest Region. 75 p. https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev2_023981.pdf

1966:

Pettinger, L.F.; Dolph, R.E. 1967. Forest insect conditions in the Pacific Northwest during 1966. Portland, OR: Insect and Disease Control Branch, Division of Timber Management, Pacific Northwest Region. 76 p. https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev2_024590.pdf

USDA FS. 1967. Forest insect conditions in the United States, 1967. Washington, DC: Division of Forest Pest Control. 42 p. http://babel.hathitrust.org/cgi/pt?id=uc1.b3552529;view=1up;seq=5

1967:

Dolph, R.E.; Pettinger, L.F. 1968. Forest insect conditions in the Pacific Northwest during 1967. Portland, OR: Insect and Disease Control Branch, Division of Timber Management, Pacific Northwest Region. 78 p. https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev2_024129.pdf

USFS. 1968. Forest insect conditions in the United States, 1967. Washington, DC: Division of Forest Pest Control. 44 p. http://babel.hathitrust.org/cgi/pt?id=uc1.b3552530;view=1up;seq=7

1968:

Pettinger, L.F.; Dolph, R.E. 1969. Forest pest conditions in the Pacific Northwest during 1968. Portland, OR: Division of Timber Management, Insect and Disease Control Branch. 20 p. https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev2_024241.pdf

USFS. 1969. Forest insect conditions in the United States, 1968. Washington, DC: Division of Forest Pest Control. 36 p. http://www.fs.fed.us/foresthealth/publications/ConditionsReport_1968.pdf

1969:

Dolph, R.E.; Pettinger, L.F. 1969. Forest pest conditions in the Pacific Northwest 1969. Portland, OR: Division of Timber Management, Insect and Disease Control Branch. 10 p. https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev2_024356.pdf

USFS. 1970. Forest insect conditions in the United States, 1969. Washington, DC: Division of Forest Pest Control. 39 p. http://www.fs.fed.us/foresthealth/publications/ConditionsReport_1969.pdf

1970:

USFS. 1971. Forest pest conditions in the Pacific Northwest 1970. Portland, OR: Division of Timber Management, Insect and Disease Control Branch. 13 p. https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev2_023982.pdf

USFS. 1971. Forest insect and disease conditions in the United States, 1970. Washington, DC: Division of Forest Pest Control. 44 p. http://www.fs.fed.us/foresthealth/publications/ConditionsReport_1970.pdf

1971:

USFS. 1971. Forest pest conditions in the Pacific Northwest 1971. Portland, OR: Division of Timber Management, Insect and Disease Control Branch. 10 p. https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev2_024591.pdf

USFS. 1972. Forest insect and disease conditions in the United States, 1971. Washington, DC: Division of Forest Pest Control. 65 p. http://www.fs.fed.us/foresthealth/publications/ConditionsReport_1971.pdf

1972:

USFS. 1973. Forest pest conditions in the Pacific Northwest 1972. Portland, OR: Division of Timber Management, Insect and Disease Control Branch. 10 p. https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev2_024732.pdf

1973:

Pettinger, L.F.; Johnson, D.W. 1974. Forest pest conditions in the Pacific Northwest 1973. Portland, OR: USFS, Division of Timber Management, Insect and Disease Control Branch. 15 p. https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev2_024733.pdf

USFS. 1975. Forest insect and disease conditions in the United States 1973. Washington, DC: Division of Forest Pest Control. 55 p. http://www.fs.fed.us/foresthealth/publications/ConditionsReport_1973.pdf

1974:

Curtis, D.J.; Johnson, D.W. 1975. Forest pest conditions in the Pacific Northwest 1974. Portland, OR: State and Private Forestry, Insect and Disease Control. 29 p. https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev2_024734.pdf

USFS. 1977. Forest insect and disease conditions in the United States 1974. Washington, DC: Forest Insect and Disease Management. 55 p. http://www.fs.fed.us/foresthealth/publications/ConditionsReport_1974.pdf

1975:

Curtis, D.J.; Hadfield, J.S. 1975. Important forest pest outbreaks in Oregon and Washington in 1975. Portland, OR: Insect and Disease Management, State and Private Forestry. 12 p. http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev2_026026.pdf

USFS: ODF; WDNR. 1976. Forest pest conditions in the Pacific Northwest during 1975. Portland, OR: State and Private Forestry, Insect and Disease Management; Salem, OR: Insect and Disease Section; Olympia, WA: Forest Land Management Division. 14 p. https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev2_023869.pdf

USFS.1977. Forest insect and disease conditions in the United States 1975. Washington, DC: Forest Insect and Disease Management. 60 p.
http://www.fs.fed.us/foresthealth/publications/ConditionsReport_1975.pdf

1976:

USFS: ODF; WDNR. 1977. Forest pest conditions in the Pacific Northwest during 1976. Portland, OR: State and Private Forestry, Forest Insect and Disease Management; Salem, OR: Insect and Disease Section; Olympia, WA: Forest Land Management Division. 14 p.
https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev2_024735.pdf

USFS.1978. Forest insect and disease conditions in the United States 1976. Washington, DC: Forest Insect and Disease Management. 40 p.
http://www.fs.fed.us/foresthealth/publications/ConditionsReport_1976.pdf

1977:

USFS: ODF; WDNR. 1978. Forest pest conditions in the Pacific Northwest during 1977. Portland, OR: Forest Insect and Disease Management; Salem, OR: Insect and Disease Section; Olympia, WA: Forest Land Management Division. 14 p.
https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev2_024357.pdf14

USFS. 1978. Forest insect and disease conditions in the United States 1977. Washington, DC: State and Private Forestry, Forest Insect and Disease Management. 88 p.
http://www.fs.fed.us/foresthealth/publications/ConditionsReport_1977.pdf

1978:

USFS: ODF; WDNR. 1979. Forest insect and disease conditions in the Pacific Northwest [in 1978]. Portland, OR: Forest Insect and Disease Management; Salem, OR: Insect and Disease Section; Olympia, WA: Forest Land Management Division. 22 p.
https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev2_024358.pdf

USFS. 1980. Forest insect and disease conditions in the United States 1978. Gen Tech. Rpt. WO-19. Washington, DC: Forest Insect and Disease Management. 83 p.
http://www.fs.fed.us/foresthealth/publications/ConditionsReport_1978.pdf

1979:

USFS: ODF; WDNR. 1979. Pacific Northwest forest pest conditions during 1979. Portland, OR: Forest Insect and Disease Management; Salem, OR: Oregon State Department of Forestry; Olympia, WA: Washington State Department of Natural Resources. 10 p.
https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev2_024592.pdf

USFS. 1981. Forest insect and disease conditions in the United States 1979. Gen Tech. Rpt. WO-20. Washington, DC: Forest Insect and Disease Management. 91 p.
http://www.fs.fed.us/foresthealth/publications/ConditionsReport_1979.pdf

1980:

Dolph, R.E. 1980. Budworm activity in Oregon and Washington 1947-1979. R6-FIDM-033-1980. Portland, OR: USDA, FS, PNW. 54 p.

USFS: ODF; WDNR; ODA. 1981. Pacific Northwest forest pest conditions during 1980. Portland, OR; Salem, OR; Olympia, WA; Salem, OR. 20 p.
https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev2_024736.pdf

USFS. 1981. Forest insect and disease conditions in the United States 1980. Washington, DC: Forest Pest Management. 36 p.
http://www.fs.fed.us/foresthealth/publications/ConditionsReport_1980.pdf

1981:

USFS: ODF; WDNR; ODA. 1981. Pacific Northwest forest pest conditions during 1981. Portland, OR; Salem, OR; Olympia, WA; Salem, OR. 26 p.
https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev2_024593.pdf

USFS. 1982. Forest insect and disease conditions in the United States 1981. Washington, DC: Forest Pest Management. 51 p.
http://www.fs.fed.us/foresthealth/publications/ConditionsReport_1981.pdf

1982:

USFS: ODF; WDNR; ODA. 1983. Pacific Northwest forest pest conditions during 1982. Portland, OR; Salem, OR; Olympia, WA; Salem, OR. 34 p. https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev2_023870.pdf

USFS. 1983. Forest insect and disease conditions in the United States 1983. Washington, DC: Forest Pest Management. 51 p. http://www.fs.fed.us/foresthealth/publications/ConditionsReport_1982.pdf

1983:

USFS: ODF; WDNR; ODA. 1983. Pacific Northwest forest pest conditions during 1983. Portland, OR; Salem, OR; Olympia, WA; Salem, OR. 29 p. https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev2_024594.pdf

USFS. 1984. Forest insect and disease conditions in the United States 1983. Washington, DC: Forest Pest Management. 72 p. http://www.fs.fed.us/foresthealth/publications/ConditionsReport_1983.pdf

USFS. 1985. Insect and disease conditions in the United States – 1979-83. Gen. Tech. Report WO-46. Washington, DC. 94 p. https://archive.org/details/CAT87881361

1984:

USFS. 1985. Forest insect and disease conditions in the United States – 1984. Washington, DC: Forest Pest Management. 90 p. http://www.fs.fed.us/foresthealth/publications/ConditionsReport_1984.pdf

1985:

USFS. 1986. Forest insect and disease conditions in the United States – 1985. Washington, DC: Forest Pest Management. 95p. http://www.fs.fed.us/foresthealth/publications/ConditionsReport_1985.pdf

1986:

USFS. 1987. Forest insect and disease conditions in the United States 1986. Washington, DC: Forest Pest Management. 94 p. http://www.fs.fed.us/foresthealth/publications/ConditionsReport_1986.pdf

1987:

USFS. 1988. Forest insect and disease conditions in the United States – 1987. Washington, DC: Forest Pest Management. 102 p. http://www.fs.fed.us/foresthealth/publications/ConditionsReport_1987.pdf

1988:

USFS. 1989. Forest insect and disease conditions in the United States – 1988. Washington, DC: Forest Pest Management. 102 p. http://www.fs.fed.us/foresthealth/publications/ConditionsReport_1988.pdf

1989:

USFS; ODF; WDNR. 1989. 1989 Forest pest conditions, Pacific Northwest Region. Portland, OR: Forest Pest Management; Salem, OR: Insect and Disease Management; Olympia, WA: Forest Land Management. 33 p. https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev2_024473.pdf

USFS. 1990. Forest insect and disease conditions in the United States – 1989. Washington, DC: Forest Pest Management. 112 p. http://www.fs.fed.us/foresthealth/publications/ConditionsReport_1989.pdf

1990:

USFS. 1991. Forest insect and disease conditions in the United States – 1990. Washington, DC: Forest Pest Management. 131 p. http://www.fs.fed.us/foresthealth/publications/ConditionsReport_1990.pdf

1991:

USFS. 1992. Forest insect and disease conditions in the United States 1991. Washington, DC: Forest Pest Management. 139 p. http://www.fs.fed.us/foresthealth/publications/ConditionsReport_1991.pdf

1992:

USFS. 1993. Forest insect and disease conditions in the United States 1992. Washington, DC: Forest Pest Management. 147 p. http://www.fs.fed.us/foresthealth/publications/ConditionsReport_1992.pdf

1993:

USFS. 1994. Forest insect and disease conditions and forest pest management activities, Pacific Northwest Region, 1993. Gen. Tech. Report. R6-FI&D-TP-11-94. Portland, OR: Forest Insects and Diseases. 54 p. https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev2_024596.pdf

USDA FS. 1994. Forest insect and disease conditions in the United States – 1993. Washington, DC: Forest Pest Management. 72 p. http://www.fs.fed.us/foresthealth/publications/ConditionsReport_1993.pdf

1994:

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ODF; USFS. 2016. Forest health highlights in Oregon – 2015. Salem, OR: Forest Health Section; Portland, OR: Forest Health Protection. 32 p.
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Appendix 2
Federal administrative history of the Oregon and Washington aerial survey program

The Oregon and Washington aerial survey program is a small group which annually accomplishes a large job on behalf of all forest land owners and managers. The details of the federal administrative history of this program are a testament to the resiliency of the dedicated employees who have prevailed in their mission for 70 years. The aerial survey program's administrative history also encompasses the evolution of the Forest Health Protection staff group.

The federal agency responsible for the Oregon and Washington aerial insect and disease survey program hasn't always been a part of the U.S. Forest Service. While the responsibility has always been with the U.S. Department of Agriculture (USDA), the survey has moved through four agencies within the Department.

While a separate insect control staff had been in the U.S. Forest Service in R6 Division of Timber Management since 1916, the aerial survey program did not become part of the U.S. Forest Service (Research) until 1953. The two programs remained separate and operated within different branches of the Forest Service until 1961. In 1961 the aerial survey program was moved out of Research and joined with the Insect Control staff in the Division of Timber Management. This combined group eventually became the current-day Forest Health Protection staff.

Subsequent to its move to USFS Research in 1953, the survey program has moved through three branches of the Forest Service (Research, National Forest Systems, and State and Private Forestry) … five times.

The administrative record, movement, and leadership record presented here reflects only the federal portion of the Oregon and Washington aerial survey program; similar organizational movement took place at each of the states, but documenting those details are beyond the scope of this report.

2.1 Federal administrative history, overview

1929: USDA, Bureau of Entomology, Forest Insect Investigations, Portland Station established

1934: USDA, Bureau of Entomology and Plant Quarantine, Forest Insect Investigations

1942: USDA, Agricultural Research Administration, Bureau of Entomology and Plant Quarantine, Forest Insect Investigations

1947 – Systematic Aerial Insect and Disease Detection Surveys begin in Oregon and Washington.

1953: USDA, Forest Service, Research, Pacific Northwest Forest and Range Experiment Station, Forest Insect Research

1961 – Survey and control personnel moved out of Research and joined with the insect control group in the Division of Timber Management

1961: USDA, Forest Service, National Forest Systems, Division of Timber Management, Insect and Disease Control

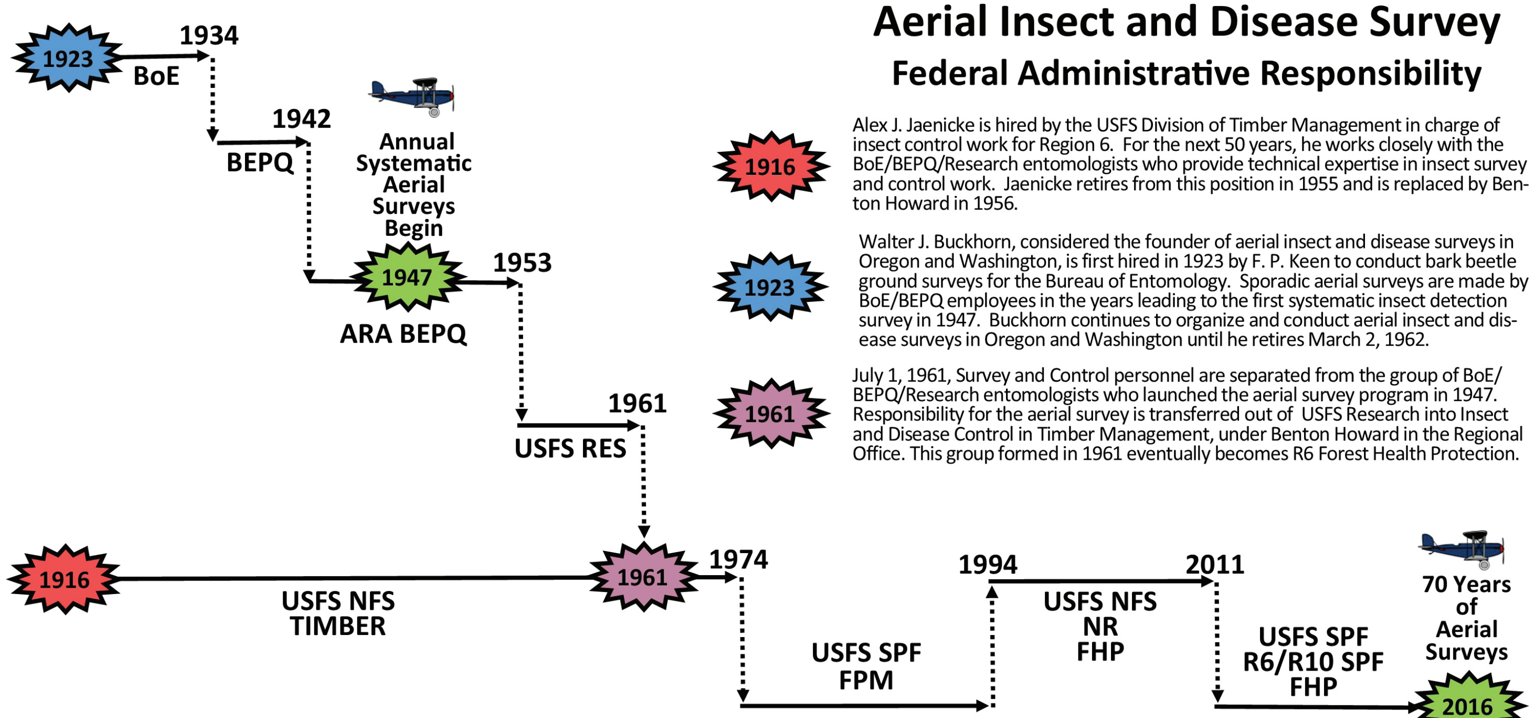
1974: USDA, Forest Service, State and Private Forestry, Forest Pest Management

1994: USDA, Forest Service, National Forest Systems, Natural Resources, Forest Health Protection

2011: USDA, Forest Service, State and Private Forestry, R6/10 State and Private Forestry, R6 Forest Health Protection

Aerial Insect and Disease Survey

Federal Administrative Responsibility



1916: Alex J. Jaenicke is hired by the USFS Division of Timber Management in charge of insect control work for Region 6. For the next 50 years, he works closely with the BoE/BEPQ/Research entomologists who provide technical expertise in insect survey and control work. Jaenicke retires from this position in 1955 and is replaced by Benton Howard in 1956.

1923: Walter J. Buckhorn, considered the founder of aerial insect and disease surveys in Oregon and Washington, is first hired in 1923 by F. P. Keen to conduct bark beetle ground surveys for the Bureau of Entomology. Sporadic aerial surveys are made by BoE/BEPQ employees in the years leading to the first systematic insect detection survey in 1947. Buckhorn continues to organize and conduct aerial insect and disease surveys in Oregon and Washington until he retires March 2, 1962.

1961: July 1, 1961, Survey and Control personnel are separated from the group of BoE/BEPQ/Research entomologists who launched the aerial survey program in 1947. Responsibility for the aerial survey is transferred out of USFS Research into Insect and Disease Control in Timber Management, under Benton Howard in the Regional Office. This group formed in 1961 eventually becomes R6 Forest Health Protection.

BoE: USDA Bureau of Entomology, Division of Forest Insect Investigations.

BEPQ: USDA Bureau of Entomology and Plant Quarantine, Division of Forest Insect Investigations. *In 1934, the BoE is combined with the Plant Disease Eradication and Control section of the Bureau of Plant Industry to become BEPQ.*

ARA BEPQ: USDA Agricultural Research Administration, Bureau of Entomology and Plant Quarantine, Division of Forest Insect Investigations. *In 1942, BEPQ is moved into the newly-formed Agricultural Research Administration (ARA).*

USFS RES: USDA Forest Service, RES, PNW Forest and Range Experiment Station, Forest Insect Research, Survey and Control Section. *In 1953 the BEPQ is abolished and the Division of Forest Insect Investigations is moved to Forest Insect Research in the US Forest Service (USFS). (RES = the Research branch of the Forest Service.)*

USFS NFS TIMBER: USDA Forest Service, NFS, Division of Timber Management, Insect and Disease Control. *July 1, 1961, under direction from the Washington Office, the Survey and Control personnel are separated from Forest Insect Research and reassigned to the Insect and Disease Control staff in Timber Management at the R6 Regional Office. This move forms the foundation of present-day Forest Health Protection. (NFS = the National Forest Systems branch of the Forest Service.)*

USFS SPF FPM: USDA Forest Service, SPF, Forest Pest Management. *In 1974, the Insect and Disease Control group moves out of Timber into the State and Private Forestry branch of the Forest Service. This is a new and independent staff, separate from Cooperative Forestry. Over the next 20+ years, the staff goes through a multitude of name changes, including: Insect and Disease Control; Forest Pest Control; Insect and Disease Management; Forest Insect and Disease Management; and Forest Pest Management (FPM). (SPF = the State and Private Forestry branch of the Forest Service.)*

USFS NFS NR FHP: USDA Forest Service, NFS, Natural Resources, Forest Health Protection. *In 1994 FPM is renamed Forest Insects and Diseases (FID) and moved back to NFS into the newly-formed Natural Resources staff; the FID Director becomes a Group Leader. FID is renamed Forest Health Protection (FHP) in 2002. Funding for FHP continues to come through the SPF branch, in keeping with the national FHP organization.*

USFS SPF R6/R10 SPF FHP: USDA Forest Service, SPF, R6/R10 State and Private Forestry, R6 Forest Health Protection. *In 2011 FHP moves out of NR, back to SPF. The new R6 SPF staff includes FHP, Invasive Plants, and Cooperative Programs and is supervised by a R6 SPF Assistant Director. (Distinction: FHP is now part of a Staff called SPF, which is also located within the SPF branch of the USFS.)*

Figure A1. *Federal administrative history of the Aerial Survey and Forest Health Protection Program in Region 6.*

2.2 Federal administrative details, 1902-2016

1902: Division of Entomology, Forest Insect Investigations established.

1904: Division of Entomology status changed to Bureau of Entomology/Division of Forest Insect Investigations by the Agricultural Appropriation Act (33 Stat. 289) on April 23, 1904.

1916: Alex Jaenicke was hired by the US Forest Service, R6 Division of Timber Management, in charge of insect control on National Forest Service managed lands. Throughout his career, Alex Jaenicke worked closely with the Bureau of Entomology entomologists, who provided the technical advice and guidance on survey and control projects.

1923: Walter J. Buckhorn (Buck), founder of aerial surveys in Oregon in Washington, was first hired by F.P. Keen of the Bureau of Entomology to conduct bark beetle ground surveys.

1929: Bureau of Entomology establishes a forest insect field station in Portland – F.P. Keen in charge.

> *The Bureau of Entomology has established a forest insect field station at Portland to serve the states of Oregon and Washington with advice regarding forest insect pests and to conduct research. This office will be in charge of Mr. F.P. Keen who for many years has been connected with bark-beetle projects in OR and CA; his assistant is Mr. J.A. Beal. They have established their office adjoining the Forest Experiment Station at 501 Lewis Building, Portland." 309 (Note: the Lewis building is located on the NE corner of SW 4th and Oak in downtown Portland.)*

F.P. Keen permanently hired Buck as a Scientific Aide to assist him in the new Portland field station.

1930: From the Bureau of Entomology directory for Portland, Oregon:

> *U.S. Entomological Laboratory (cooperation with Federal Forest Service, National Park Service, and Office of Indian Affairs, and with organizations of private owners of forest land).—Located at 501 Lewis Building, within walking distance of street cars. Investigations of the western pine beetle, the mountain pine beetle, the hemlock looper, and the hemlock bud moth and methods for their control. F.P. Keen, entomologist in charge.*[310]

1932: Bureau of Plant Quarantine created July 7, 1932 (47 Stat. 640).

1933: On July 1, 1933[311], both the BoE, Division of Forest Insect Investigations and the Pacific Northwest Forest Experiment Station move their offices into the new Federal Court House at S.W. 6th Avenue and S.W. Main Street, Portland, Oregon.[312]

1934: Bureau of Entomology and Bureau of Plant Quarantine consolidated with disease control and eradication functions of Bureau of Plant Industry into Bureau of Entomology and Plant Quarantine (BEPQ). [313] **Effective July 1, 1934, by the Agricultural Appropriation Act (48 Stat. 486), March 26, 1934.**

1940: BEPQ directory, Portland, Oregon:

> *Laboratory, Division of Forest Insect Investigations. –Room 445, United States Courthouse, Sixth and Main Streets, Telephone, Atwater 6171, extension 632. F.P. Keen, senior entomologist, in charge.*
>
> *Supervision of bark-beetle survey and control projects in Oregon and Washington. Studies of the western pine beetle, mountain pine beetle, carpenter ant, and other insects, and methods of control. Special studies of climatic factors influencing the abundance of bark beetles and the rise and fall of epidemics. In cooperation with the National Forest Service, National Park Service, Office of Indian Affairs, State forestry department and organizations of private owners of forest land.*[314]

[309]From 'Station News Items', in Forest Research Notes issued by the Pacific Northwest Forest Experiment Station – Oct. 20, 1929. On file at Cascade Head Experimental Forest.

[310]Bureau of Entomology Directory of Field Activities, July 1930, page 32.

[311]Prior to 1976, the federal Fiscal Year began on July 1 and ran through June 30.

[312]Renamed the Gus J. Solomon U.S. Courthouse in 1989.

[313]Only the forest tree disease control and eradication functions of BPI was transferred to BEPQ in 1934; forest tree disease research continued within BPI until 1953.

[314]Directory of the Bureau of Entomology and Plant Quarantine. Miscellaneous Publication No. 220, Revised, September 1940. p. 68 and 69.

1942: Agricultural Research Administration (ARA) established and BEPQ transferred to ARA; both by EO 9069 on February 23, 1942. (ARA later superseded by Agricultural Research Service (ARS) November 2, 1953.)

F.P. Keen left the Portland lab for CA; R.L. Furniss in charge behind Keen.

1947: Forest Pest Control Act of 1947 (61 Stat. 177; Public Law 110) passed on June 25, 1947. (See Appendix 3.) **Systematic aerial surveys begin.**

1953: BEPQ abolished by Secretary of Agriculture's Memorandum No. 1320, suppl. 4, November 2, 1953.

> *On October 13 [1953] Secretary Ezra T. Benson announced plans for reorganizing the USDA. … Responsibility for insect and disease research was given to the Forest Service. In the Pacific Northwest, programs, personnel and facilities of the Portland Forest Insect Laboratory, Bureau of Entomology and Plant Quarantine, and the Portland Division of Forest Pathology, Bureau of Plant Industry, Soils and Agricultural Engineering are transferred to the station where they will be respectively the Division of Forest Insect Research and the Division of Forest Disease Research. Division of Insect Research will be headed by R.L. Furniss and consists of 8 technical personnel and the second is headed by J.L. Bedwell and consists of 5 technical personnel. Although the transfer did not become effective until Janurary 3, 1954, it was considered appropriate to record 1953 activities and accomplishments … in this report.*[315]

Station director Robert Cowlin recalled the 'move' to the Forest Service thus:

> *The transfer of the forest insect and forest disease groups was made effective December 20, 1953 and the Divisions of Forest Insect Research and Forest Disease Research were official members of the Station before the close of 1953 – before Christmas for that matter, a cause for celebration and strengthening of the Station generally. Upon transfer, the Forest Insect Division staff consisted of Robert L. Furniss, division chief; John M. Whiteside, Walter J. Buckhorn, Wm. K. Coulter, Kenneth H. Wright, and Wm. F. McCambridge, entomologists; John F. Wear, air pilot and research forester; and Wilma M. Taylor, clerk-stenographer. The Forest Disease Division staff consisted of Dr. Jesse L. Bedwell, Dr. Thomas W. Childs, George Harvey, and Dr. Ernest Wright, pathologists, and Zella A. Manwaren, clerk-stenographer. The activities of the Division of Forest Insect Research consisted of three major lines of work: research, forest insect surveys, and technical supervision of forest insect control projects.*[316]

1954: The Research Station moved out of the Federal Courthouse [Gus Solomon] and in with the Regional Office:

> *In June 1954, the Station headquarters in Portland were moved to 729 N.E. Oregon St. [Portland, OR] in a two-story building, and tourist center in that general area. The Regional Office was also moving to the same building, bringing many advantages in external and internal relations. It made possible the location of the Division of Forest Disease Research with the other divisions and provided laboratory and storage space in the basement level.*[317]

1955: Alex Jaenicke retired from the Forest Service.

1956: Benton Howard was hired to replace Alex Jaenicke as head of Insect and Disease Control in R6, Division of Timber Management:

> **Benton Howard Moves to Northwest Forest Region:**
>
> *Transfer and promotion of Benton Howard, assistant chief of blister rust control for the California Region of the U.S. Forest Service was announced recently by Regional Forester Chas. A. Connaughton. Mr. Howard's new position, effective in October, is chief of insect and disease control in the timber management division of the Northwest Region of the Forest Service with headquarters in Portland, Ore. Howard will be*

[315]PNFRES. 1954. Annual report 1953. Portland, OR. p. 2.

[316]Cowlin, R.W. 1988. Federal forest research in the Pacific Northwest. USDA Forest Service, Pacific Northwest Research Station. p.148.

[317]Ibid. p. 144.

> *in charge of directing surveys[318] of forest insect and disease concentrations and the control work necessary to reduce losses in the forests of Oregon and Washington. White pine blister rust control will be a large part of his work. He has spent nearly 25 years in combating blister rust in California.[319]*

1958: Research Station personnel moved out of the Regional Office at 729 N.E. Oregon St., due to crowded conditions. The new Research office was located two blocks away on the 3rd and 4th floors of the old Dental College building at 809 NE 6th Ave., Portland, OR. From Robert Cowlin's letter in the May 1958 edition of *Timberlines*:

> *The most important current news is that within the next few weeks we are moving to new quarters two blocks away. The old Dental College building [809 NE 6th Avenue] has been remodeled and we will occupy the second, third, and part of the fourth floors. These quarters will provide much needed room for the Station, and our departure from this building [Regional Office at 729 NE Oregon St.] will help relieve the crowded conditions in the Regional Office.*
> *R.W. Cowlin, Director, Pacific Northwest Range and Experiment Station*

1961: Survey and control personnel in R6 were transferred out of Research, into the Division of Timber Management (National Forest Systems), effective July 1, 1961.

On July 1, 1961 Buckhorn and the other aerial survey and control employees were administratively moved out of PNW Research and reassigned to the Division of Timber Management in the Regional Office under Benton Howard, Branch Chief, Insect and Disease Control. This move, and the newly-combined group, eventually became current-day Forest Health Protection.

While effective at the beginning of the new Fiscal Year on July 1, 1961, the physical move to Timber did not happen until sometime later in 1962, due to the shortage of physical space in the R6 Regional Office.

1965: The Regional Office moved to the Old Hotel Multnomah at 319 SW Pine Street, Portland, Oregon.

1971: David Graham replaced Benton Howard as the Branch Chief, Insect and Disease Control, Division of Timber Management.

1974: Insect and Disease Control was moved out of the Division of Timber (National Forest Systems branch of the Forest Service) and became an independent staff group within the State and Private Forestry branch of the Forest Service. David Graham continued as the Director of the new SPF/Insect and Disease Control staff.

1975: Insect and Disease Control name changed to Insect and Disease Management.

1977:
Director Dave Graham transferred to the WO.

Insect and Disease Management name changed to Forest Insect and Disease Management.

Paul Buffam was hired as Forest Insect and Disease Management Director.

1981: Forest Insect and Disease Management name changed to Forest Pest Management (FPM).

1986: Paul Buffam retired Feb. 1; various FPM personnel served as acting Director for the next two years.

1988: New FPM Director, Bill Ciesla, arrived March 1988.

[318]The surveys mentioned here are ground surveys, not the aerial survey program; the aerial surveys are still under the supervision of R.L. Furniss in Research at this point.

[319]Journal of Forestry. 1956. Forestry news. 54(12):875.

1988-1990: Regional Office FPM staff decentralized and three zone offices created: one zone attached to the Wallowa-Whitman NF in La Grande, OR (Don Scott, entomologist and Craig Schmitt, pathologist); another attached to the Deschutes NF in Bend, OR (Andy Eglitis, entomologist and Helen Maffai, pathologist); and a third zone office on the Wenatchee NF in Wenatchee, WA (Paul Flanigan, entomologist and Paul Hessburg, pathologist) to serve all of Washington east of the Cascades.

1990: Bill Ciesla left R6 for an FAO assignment in June 1990.

Max Ollieu arrived as new FPM Director in November 1990.

1992: The Regional Office moved out of the condemned Hotel Multnomah building at 319 SW Pine into newly-constructed office space in the Robert Duncan Plaza, 333 S.W. 1st Avenue, Portland, OR.

1994: Forest Pest Management (FPM) name changed to Forest Insects and Diseases (FID).

FID staff was moved into Natural Resources in the RO, and placed under Director Robert Devlin. Max Ollieu's former Director position was changed to 'Group Leader' under the new Natural Resources organization; this position was downgraded from a GS-15 to a GS-14 when he retired. This move put the R6 staff back in the National Forest Systems branch of the Forest Service.

Two new west-side Technical Centers were created. More about this reorganization from the 1993 regional conditions report:

> *For the last several years FPM has been represented in the Region by the FPM staff unit in the Regional Office (RO) and three zone offices. The RO staff consisted of a pathology group, an entomology group, a planning group/integrated pest management group, and an operations group. Field offices were the Central Oregon Pest Management Zone located in Bend, OR; the Blue Mountains Pest Management Zone in La Grande, OR; and the Eastern Washington Forest Health Office in Wenatchee, WA. Reviews of the three zone programs were conducted in 1992. Based on these reviews, decentralization was expanded to include the west side of the Cascades, adding two technical centers.*[320]

And from the 1994 regional *Conditions Report*:

> *The Southwest Oregon Technical Center staff, housed at the J. Herbert Stone Nursery in Central Point, Oregon: Ellen Michaels Goheen, Plant Pathologist; Don Goheen, Plant Pathologist; Katy Marshall, Forester/Plant Pathologist.*
>
> *The Westside Technical Center staff, hosted by the Mt. Hood NF in Sandy, OR (Westside Tech. Center temporarily housed at the Columbia Gorge Ranger Station, until the new Mt. Hood NF headquarters building is completed): Jerome Beatty, Program Manager/Plant Pathologist; Bruce Hostetler, Entomologist; Keith Sprengel, Forestry Technician; Elizabeth Willhite, Entomologist.*
>
> *Both centers staffed in April 1994.*[321]

The original distinction made between the two new Technical Centers and the three existing Zones:

> **Technical Centers:** *Have a larger service area and clientele base than Zone offices; ultimately envisioned to have a staff of 4-6 people; conduct basic FPM services and responsibilities for federal land managers; assume some of the regional and national level responsibilities; and to be available to the regional office FPM staff as needed to address these issues; headed up by a GS 13 group leader to reflect these increased responsibilities.*

[320]USDA FS. 1994. Forest insect and disease conditions and forest pest management activities, Pacific Northwest Region, 1993. Gen. Tech. Report. R6-FI&D-TP-11-94. Portland, OR: Forest Insects and Diseases. p. 26.

[321]Sprengel, K. 1995. Forest insect and disease conditions Pacific Northwest Region, 1994. Portland, OR: Gen. Tech. Rep. R6-FI&D-TP-06-95. p. 33-35.

> **Zone Offices:** *conduct basic FPM services and responsibilities for federal land mangers; generally consists of 2 professional specialists and possibly one, or part of one technician to fulfill Zone's work; may participate in a limited amount of regional or national level work, but is not a significant part of their responsibilities, and for the most part are not available to the regional office staff to address regional or national issues.*

But, within a few years, all five field offices (both the Zones and Technical Centers) were renamed Service Centers.

1997: Max Ollieu retired.

1998: Ken Snell became the FID Group Leader in NR behind Max and brought the Air Quality program with him.

2001:
Ken Snell moved to the Deputy Director of Fire and Aviation Management.

Douglas Daoust became the acting NR/FID Group Leader October 21, 2001.

Bruce Hostetler took over WSC supervision behind Jerry Beatty.

2002:
Forest Insects and Diseases (FID) renamed Forest Health Protection (FHP).

Douglas Daoust hired permanently as FHP Group Leader, September 2002. In addition to FHP, he also had responsibility for the Air Quality and Invasives staff groups.[322]

Robert Schroeter hired as the first Oregon USFS lead surveyor, positioned at the Southwest Oregon Service Center (SOSC); supervision provided by Ellen Michaels Goheen.

Benjamin Smith hired as the first Washington USFS lead surveyor, positioned at the Westside Service Center (WSC); supervision provided by Bruce Hostetler.

2006: David Bridgwater passed the regional aerial survey program manager duties to Keith Sprengel. Keith's supervision continued with the WSC and Bruce Hostetler. Historic aerial survey program files were moved to Keith's WSC office located at the Mt. Hood National Forest headquarters, 16400 Champion Way, Sandy, Oregon 97055.

2010: The aerial survey map room equipment, historic map files, and the aerial survey GS-9 biological technician position and supervision were moved out of the Regional Office to the WSC at the Mt. Hood National Forest headquarters in Sandy, Oregon.

Bruce Hostetler retired in 2010 and Beth Willhite took over supervision of the three aerial survey positions at WSC.

2011: Forest Health Protection was moved out of NFS/Natural Resources, back to the State and Private Forestry branch of the Forest Service. The Air Quality staff stayed in NR and FHP was joined with Cooperative Forestry and Invasive Plants to form a new R6 State and Private Forestry staff. This new staff was supervised by GS-14, R6 Assistant Director Douglas Daoust, under a GS-15 joint R6/R10 State and Private Forestry Director, filled in April 2011 by Peg Polichio. FHP's organizational structure in 2011 became: USDA, Forest Service, Pacific Northwest Region, State and Private Forestry (branch), R6 State and Private Forestry (staff), FHP.

[322]Note: The FHP budget and the national FHP organization remained in State and Private Forestry branch; because of this Max, Ken, and Doug continued as the R6 Director of Forest Health Protection within the national FHP Directors' group, even after the downgrade to 'Group Leader' in NR.

2013: The US Forest Service Regional Office moved from the Robert Duncan Plaza at 333 SW 1st Ave. to the Edith Green Wendell Wyatt Federal Building at 1220 SW 3rd Ave, Portland, OR 97204; R6 State and Private Forestry/FHP staff located on the 16th floor.

Keith Sprengel, R6 regional aerial survey program manager, retired on May 3, 2013; Ben Smith designated as acting aerial survey program manager.

2014:
R6/R10 State and Private Forestry Director Peg Polichio retired June 2014. In October 2014 Teresa Raaf replaced Peg Polichio as the R6/10 State and Private Forestry Director.

Ben Smith hired as regional aerial survey program manager behind Keith Sprengel, fall 2014. His office location and supervision continued at the WSC at the Mt. Hood NF headquarters in Sandy, OR.

2015:
Douglas Daoust retired from the Forest Service January 2, 2015 to serve, fulltime, as the Mayor of Troutdale.

Karl Dalla Rosa was hired in April to replace Doug as R6 Assistant Director of State and Private Forestry.

R6/10 SPF Director Teresa Raaf retired in October 2015.

2016: Debbie Hollen replaced Teresa Raaf as the R6/R10 State and Private Forestry Director, effective January 2016.

Forest Health Protection Regional Office personnel, September 1, 2016:

Director: Debbie Hollen

Assistant Director: Karl Dalla Rosa

Supervisory Budget Analyst/Grants and Agreements: Becky Slick

Regional Forest Entomologist: Iral Ragenovich

Regional Forest Pathologist: Kristen Chadwick (acting behind Greg Filip)

Entomologist/Forest Health Monitoring: Karen Ripley (report date October 2016)

Lead Grants and Agreements Coordinator: Sheila Walker

Office Assistant: Cathy Selby

GIS Analyst: Zack Heath

Information Specialist: Julie Johnson

US Forest Service - Pacific Northwest Region

Forest Health Protection

Service Centers

Wenatchee Service Center
Forestry Sciences Laboratory
1133 N. Western Ave.
Wenatchee, WA 98801

Darci Dickinson - *Forest Entomologist*
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Brennan Ferguson - *Forest Pathologist*
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Betsy Goodrich - *Forest Pathologist*
(509-664-9223) agoodrich@fs.fed.us

Roy Magelssen - *Biol. Sci. Technician*
(509-664-9214) rmagelssen@fs.fed.us

Connie Mehmel - *Forest Entomologist*
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Westside Service Center
Mount Hood National Forest
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Sandy, OR 97055

Kristen Chadwick - *Forest Pathologist*
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Zack Heath - *GIS Analyst*
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Justin Hof- *Aerial Observer*
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Holly Kearns - *Forest Pathologist*
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Sundi Sigrist - *Biological Technician*
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Ben Smith - *Aerial Survey Prog.Mgr.*
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Beth Willhite - *Forest Entomologist*
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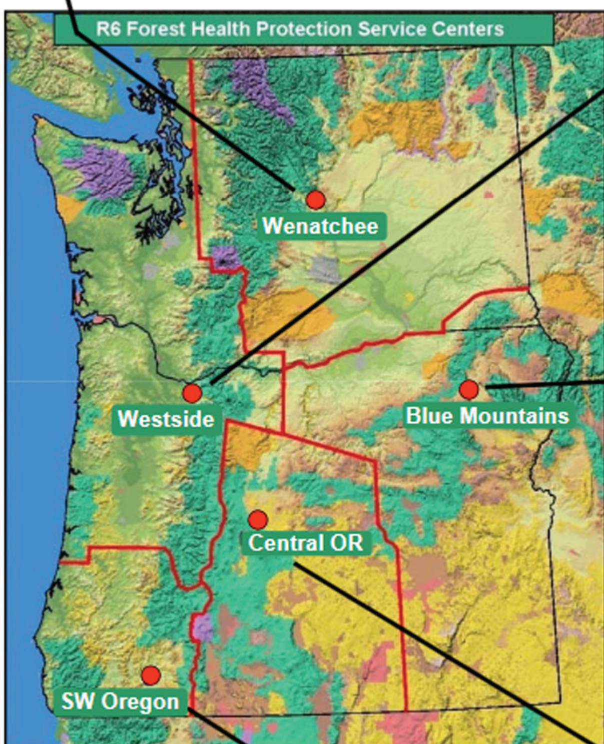

Blue Mountains Service Center
Forestry Sciences Laboratory
1401 Gekeler Lane,
La Grande, OR 97850

Michael Jennings - *Ecologist*
(541-962-6530) michaeldjennings@fs.fed.us

Mike Johnson - *Forest Entomologist*
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Michael McWilliams - *Forest Pathologist*
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Lia Spiegel - *Forest Entomologist*
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Southwest Oregon Service Center
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Central Point, OR 97502

Josh Bronson - *Forest Pathologist*
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Ellen Michaels Goheen - *Forest Pathologist*
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Ron Rhatigan - *Sudden Oak Death Forester*
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Bill Schaupp - *Forest Entomologist*
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Bob Schroeter - *Aerial Observer*
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Central Oregon Service Center
Deschutes National Forest
63095 Deschutes Market Rd.
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Paul Deignan - *Biological Science Tech*
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Robbie Flowers - *Forest Entomologist*
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Helen Maffei - *Forest Pathologist*
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Brent Oblinger - *Forest Pathologist*
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Mike Simpson - *Ecologist/Analyst*
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Figure A2. *R6 Service Center Personnel, as of June 10, 2016.*

Appendix 3
Federal and state authorities to fund and conduct cooperative aerial surveys

A variety of laws pertain to the conduct and payment of the cooperative aerial survey by state and federal employees. The original legal basis for conducting aerial insect and disease detection surveys is the Forest Pest Control Act (FPCA) of 1947; this was the first law that allowed use of federal funds for insect and disease detection. The FPCA allowed systematic aerial detection surveys in Oregon and Washington to commence in 1947. The Forest Pest Control Act was supplanted by the Cooperative Forestry Assistance Act of 1978. This law re-framed cost-sharing between the states and the federal government to conduct aerial detection surveys.

3.1 Legal authorities

1914:

Cooperative Funds Act of June 30, 1914 (16 U.S.C. 498, as amended)

1947:

Forest Pest Control Act of 1947; Public Law 110. Approved June 25, 1947. 80th Congress.

This act authorizes the Secretary of Agriculture to use Federal funds to conduct surveys to detect and evaluate forest insect and disease outbreaks and to prevent, retard, control, suppress, or eradicate injurious forest insect pests and tree diseases on all forest lands in cooperation with Federal land-managing agencies, the States and private owners of forest land. The Secretary of Agriculture has delegated to the Forest Service the responsibility for carrying out the provisions of these acts. (See Appendix 3.3.1 for full text)

1950:

Granger-Thye Act of April 24, 1950 (16 U.S.C. 572)

Authorized the Forest Service to participate in funding cooperative forestry and rangeland resource improvements; and, authorized the Forest Service to assist with work on private forest lands.

1951:

State of Oregon – Forest Pest Control Act; Oregon Laws 1951, Chapter 66, Approved February 22, 1951, 46th Legislative Assembly, Regular Session (See Appendix 3.3.2 for full text.)

Cooperation between the Oregon State Board of Forestry and the U.S. Bureau of Entomology and Plant Quarantine – letter from John B. Woods, Jr. Deputy State Forester:

The administration of the 1949 and 1950 [budworm] control programs by the Oregon State Board of Forestry disclosed certain weaknesses in the Oregon Insect Pest Act [of 1921]. As a result recommendations were made to the 1951 legislature for revisions. On the basis of these recommendations, the legislature repealed the Oregon Insect Pest Act and in its place enacted the Forest Insect and Disease Control Act.

John concluded his report with the following:

The Oregon Insect and Disease Control Act appears to be working satisfactorily and might well be used as a pattern in other states which do not have such legislation.[323]

The State of Washington quickly followed suit and passed their legislation on March 19, 1951.

State of Washington - Cooperative Control of Forest Insects and Diseases: Washington Laws of 1951, Chapter 233; Approved March 19, 1951; 32nd Session of the Legislature. (See Appendix 3.3.3 for full text.)

1975:

Forest Pest Control Act Amendment – H.R. 1670 (April 24, 1975) and H.R. 5634 (June 19, 1975); Serial No. 94-I

- H.R. 5634: A bill to authorize the Secretary of Agriculture to reimburse cooperators for work performed which benefits Forest Service programs.
- H.R. 1670: A bill to amend the Forest Pest Control Act of June 25, 1947.

1978:

Cooperative Forestry Assistance Act of 1978 (CFAA 1978) - (Public Law 95-313 6 U.S.C. §§2101-2111, July 1, 1978). (See Appendix 3.3.4 for full text.)

Forest Heath Protection: The act authorizes the Secretary to protect trees, forests, wood products and stored wood on National Forest System land and other lands in the U.S. from natural and human threats. Congress authorized to be appropriated annually sums to carry out the general provisions of this program, and $10,000,000 annually to carry out a program of integrated pest management. § 2104.

CFAA 1978, as amended through P.L. 110-246, Effective May 22, 2008. Section 8 [16 U.S.C 2104]

Forest Health Protection:

(b) Activities: Subject to subsections (c), (d), and (e) and to such other conditions the Secretary may prescribe, the Secretary may, directly on the National Forest System, in cooperation with other Federal departments on other Federal lands, and in cooperation with State foresters, or equivalent State officials, subdivisions of States, agencies, institutions, organizations, or individuals on non-Federal lands –

[323] Hardcopy ODF binder on file in Sandy, OR. [No Date]. Cooperation between the Oregon State Board of Forestry and the U.S. Bureau of Entomology and Plant Quarantine in Forest Insect Control Programs. [signed] John B. Woods, Jr. Deputy, State Forestry.

(1) Conduct surveys to detect and appraise insect infestations and disease conditions and man-made stresses affecting trees and establish a monitoring system throughout the forests of the United States to determine detrimental changes or improvements that occur over time, and report annually concerning such surveys and monitoring.

1992:

Department of Interior and Related Agencies Appropriations Act of 1992 (Public Law 102-154)

State and private forestry: For necessary expenses of cooperating with, and providing technical and financial assistance to States, Territories, possessions, and others; and for forest pest management activities.

1999:

The Wyden Amendment, Section 323(a) of the Department of Interior and Related Agencies Appropriations Act, 1999, as included in Public Law 105-277, Div. A., Section 101 (e) as amended by Public Law 109-54, Section 434, and the Omnibus Public Land Management Act, Public Law 111-11, Section 3001

Authorizes the Forest Service to enter into cooperative agreements with willing Federal, tribal, State and local governments, private and nonprofit entities, and landowners for the protection, restoration, and enhancement of fish and wildlife habitat, and other resources on public or private land that benefit those resources within the watershed.

2011:

36 CFR 230.40: Eligible practices for cost-share assistance:

(7) Forest Health Protection – establishment, maintenance, and restoration practices to create, protect, improve, or restore forest health, including detection and control of insects, diseases, and animal damage to established stands.

3.2 Forest Service Manual direction

Forest Service Manual (FSM), Chapter's 3400 and 3410, provide direction for Forest Health Management, including insect and disease detection survey responsibilities.

FSM 3404.21: *Regional or Area Staff Director Having Forest Health Management Responsibilities within the Region or Area, the Director assigned forest health management responsibilities shall:*

1. *Provide advice and guidance to National Forests, other Federal agencies, and States on forest health management and pesticide use.*
2. *Conduct surveillance and detection surveys to ensure prompt discovery of potentially threatening pest populations and/or damage to forest vegetation.*
3. *Conduct biological evaluations to determine the need to initiate, continue, intensify, revise, or discontinue pest management activities and, upon request, make pest management recommendations.*
4. *Work with Federal and State personnel to evaluate and determine the need to initiate, continue, intensify, revise, or discontinue pest management activities and, upon request, make pest management recommendations.*
5. *Conduct pest management training for resource managers, and provide specialized training for Forest and District unit pest management specialists to facilitate the training and certification of pesticide applicators.*
6. *Identify forest pest problems as candidates for research programs.*
7. *Transfer technology through field studies, pilot projects, demonstration areas, and technical assistance.*

FSM 3412: Detection Surveys

Regional and Area Forest Health Management Staffs shall conduct detection surveys on Federal Land, and if necessary, on non-Federal lands as often as necessary to provide insect and disease status information. Upon request and under mutual agreement, Forest Service personnel may conduct detection surveys on State and private lands, or conversely State personnel may conduct surveys on National Forest System Land.

Wilderness manual direction:

FSM 2300: Recreation, Wilderness and Related Resource Management

2324.1: Management of Insects and Diseases

2324.13: Detection

Conduct surveys to monitor forest insects or diseases in wilderness in a manner that preserves the wilderness character of the area. Generally this will be in the same manner as that prescribed for other National Forest System lands (FSM 3412). Modify any procedures that are in conflict with wilderness management objectives.

Forest Service direction on the use of aircraft:

FSM 5700: Aviation Management

Forest Service Handbook (FSH) 5709.16: Flight Operations Handbook

3.3 Full text of selected laws

3.3.1 Forest Pest Control Act of 1947

Passed as Public Law 110. Approved June 25, 1947. 80th Congress.

An Act

To provide for the protection of forests against destructive insects and diseases, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of American in Congress assembled, That in order to protect and preserve forest resources of the United States from ravages of bark beetles, defoliators, blights, wilts, and other destructive forest insect pests and diseases, and thereby enhance the growth and maintenance of forests, promote the stability of forest-using industries and employment associated therewith, aid in fire control by reducing the menace created by dying and dead trees injured or killed by insects or diseases, conserve forest cover on watersheds, and protect recreational and other values of forests, it shall be the policy of the Government of the United States independently and through cooperation with the Government of States, Territories, and possessions, and private timber owners to prevent, retard, control, suppress, or eradicate incipient, potential, or emergency outbreaks of destructive insects and diseases on, or threatening, all forest lands irrespective of ownership.

SEC. 2. The Secretary of Agriculture is authorized either directly or in cooperation with other departments of the Federal Government, with any State, Territory, or possession, organization, person, or public agency, subject to such conditions as he may deem necessary and using such funds as have been, or may hereafter be, made available for these purposes, ***to conduct surveys on any forest lands to detect and appraise infestations of forest insect pests and tree diseases****, to determine the measures which should be applied on such lands, in order to prevent, retard, control, suppress, or eradicate incipient, threatening, potential, or emergency outbreaks of such insect or disease pests, and to plan, organize, direct, and carry out such measures as he may deem necessary to accomplish the objectives and purposes of this Act: Provided, That any operations planned to prevent, retard, control, or suppress insects or diseases on forest lands owned, controlled, or managed by other agencies of the Federal Government shall by conducted with the consent of the agency having jurisdiction over such land.*

SEC. 3. The Secretary of Agriculture may, in his discretion and out of any money made available pursuant to this Act, make allocations to Federal agencies having jurisdiction over lands held or owned by the United States in such amounts as he may deem necessary to retard, control, suppress, or eradicate injurious insect pests or plant diseases affecting forests on said lands.

SEC. 4. No money appropriated to carry out the purposes of this Act shall be expended to prevent, retard, control, or suppress insect or disease pests on forest lands owned by persons, association, corporation, States, Territories, possessions, or subdivisions thereof until such contributions toward the work as the Secretary may require have been made or agreed upon in the form of funds, services, materials or otherwise.

SEC. 5. There are hereby authorized to be appropriated for the purposes of this Act such sums as the Congress may from time to time determine to be necessary. Any sums so appropriated shall be available for necessary expenses, including the employment of persons and means in the District of Columbia and elsewhere, printing and binding, and the purchase, maintenance, operation, and exchange of passenger-carrying vehicles; but such sums shall not be used to pay the cost or value of any property injured or destroyed. Materials and the equipment necessary to control, suppress, or eradicate infestations of forest insects or tree diseases may be procured without regard to the provisions of section 3709 of the Revised Statutes (41 U.S.C. 5) under such procedures as may be prescribed by the Secretary of Agriculture, when deemed necessary in the public interest.

SEC. 6. The provisions of the Act are intended to supplement, and shall not be construed as limiting or repealing existing legislation.

SEC. 7. This Act may be cited as the "Forest Pest Control Act."

3.3.2 1951 State of Oregon – Forest Pest Control Act

Oregon Laws 1951, Chapter 66, Approved February 22, 1951, 46th Legislative Assembly, Regular Session

AN ACT:

Relating to the control, destruction and eradication of forest insect pests and forest tree diseases, and creating the Forest Insect and Disease Control Fund; repealing section 107-261 to 107-270, inclusive, O.C.L.A. and chapter 324, Oregon Laws 1941, and chapter 336, Oregon Laws 1945; and declaring and emergency.

Be It Enacted by the People of the State of Oregon:

Section 1. Forest insect pests and forest tree diseases harmful, detrimental and injurious to timber and forest growths infested thereby hereby are declared to be a public nuisance.

Section 2. Every owner of timberlands or timber shall control, destroy and eradicate such forest insect pests and forest tree diseases, or provide for the same to be done on timberlands or timber owned by him under his control, but in case of his failure, neglect or inability to do so, such work may be performed as provided in this Act.

Section 3.

(1) Whenever the State Forester finds timberlands or timber infested with forest insects or forest tree diseases, and if he finds that such infestation is of such character as to be harmful, detrimental and injurious to timber and forest growths, with respect to the value of the timberlands or timber to be protected, the State Forester shall, with the approval of the State Board of Forestry, designate an Infestation Control District and declare and fix the boundaries thereof so as definitely to describe and identify each district. The district may include timberlands or timber threatened by the infestation as well as those timberlands or timber already infested, but shall include only timberlands or timber within the boundaries of either the official fire district now or hereafter designated under the provision of section 107-207, O.C.L.A., and amendments thereto, or of the United States National Forest within which the infested timberlands or timber are situated.

(2) Immediately thereafter the State Forester shall notify in writing all owners of timberlands or timber within the district to proceed without delay to destroy and eradicate the forest insect pests or forest tree diseases as provided in this Act. The notice may be served by delivery of a copy of the notice to the owner, or by mail addressed to the last known place of address of the owner, sealed, plainly addressed, with the requisite amount of postage stamps thereon, and deposited in the United States post office; in addition there shall be published a legal description of the Infestation Control District, which publication shall be made at least once a week for two consecutive weeks in one or more newspapers having a general circulation in the county, or counties, in which the said Infestation Control District is situated.

Section 4. IF an owner so notified, fails, refuses, neglects or is unable to undertake compliance with the requirements of the notice within a period of 30 days after the date of service, it shall be the duty of the State Forester, using such funds as have been or hereafter may be made available, alone or in cooperation with the owners involved, to proceed with the eradication and destruction of such forest insect pests or forest tree diseases in a manner approved by the State Board of Forestry. However, the State Forester shall not proceed with such eradication and destruction within the Infestation Control District so long as an owner notified as provided in section 3 proceeds within 30 days and continues in good faith thereafter to eradicate and destroy the forest insects pests and forest tree diseases upon such timberlands or timber in manner approved by the State Board of Forestry. Nor shall the State Forester proceed with the eradication and destruction of forest insect pests or forest tree diseases upon the timberlands or timber of an owner in an Infestation Control District who is a member of a cooperative association of timberland or timber owners which actively engages in the destruction, control and eradication of the forest insect pests and forest tree diseases, using methods approved by the State Board of Forestry.

Section 5. Upon completion of any work authorized and performed under the provisions of section 4, the State Forester shall prepare a certified statement of the expenses necessarily incurred in performing the work of eradicating the forest insect or forest tree diseases. The state may assist in the payment of control costs from funds available for that purpose and in amounts to be determined by the State Board of Forestry. The balance of such expenses, after deducting the sum of such amounts as may be contributed by the State of Oregon, by the Federal Government or by any other agencies, companies, corporations or individuals to defray control costs, shall constitute a charge against the timberlands or timber involved. The existence of the charge shall be reported by the State Forester to the tax levying authority for the county in which such timberlands or timber are situated, and the said charge shall become a lien against the said property and shall become due and payable at the same time and in the same manner, with the same interest, penalty and cost charges as apply to the ad valorem property taxes in this state, and in case of delinquency, shall be subject to the same procedure for the foreclosure thereof as are property tax liens, provided, however, that if said lien be not paid within 90 days after the return is due, it shall be the duty of the district attorney of the county upon request of the State Board of Forestry to bring suit for the foreclosure of said lien. In case the timberlands or timber against which there is a charge lie in more than one county, the State Forester shall prorate the charge and report the existence thereof to the respective tax levying authorities for the counties in which such timberlands or timber are located. The tax levying authority shall instruct the proper officer to expend the charges on the assessment roll in a separate column, and the procedure and remedies provided by the law for the collection of taxes and delinquent taxes shall be applicable thereto. Upon collection of the charges, the county court or board of county commissioners shall cause the amounts thereof to be paid to the State Forester. Any unpaid charge or lien against timberlands or timber or dissolution of the Infestation Control District.

Section 6. All moneys collected under the provisions of section 5, together with such moneys as may be appropriated by the legislature for the purposes of this Act, and with such moneys as may be contributed by the Federal Government or by any agencies, companies, corporations or individuals, shall be deposited in the State Treasury to the credit of the Forest Insect and Disease Control Fund, which fund herein is created, and the moneys therein hereby are appropriated to the State Board of Forestry for the purposes of this Act.

Section 7. Whenever the State Board of Forestry shall determine that forest insect pest or forest tree disease control work within the designated Infestation Control District is no longer necessary or feasible, the board by resolution may dissolve the district.

Section 8. For the purposes of this Act any land shall be considered timberland which has enough timber or forest growths, standing or down, to constitute, in the judgment of the State Board of Forestry, a forest insect pest or forest tree disease breeding ground of a nature to be harmful, detrimental and injurious to timber or forest growth in the district under consideration.

Section 9. The term "owner" as used in this Act shall be the person, partnership, corporation or association owning timberlands or timber as shown on the latest records of the tax collector of the county in which such timberlands or timber are situated. Where timber is owned entirely separate and apart from the land whereon it grows or is situated, the term "owner" shall be the person, partnership, corporation or association owning such timber as shown on the latest records of the tax collector of the county in which such timber is situated.

Section 10. The State Board of Forestry herby is authorized and empowered to accept funds from any source for use in protecting timberlands or timber within the state from white pine bluster rust, in cooperation with agencies of the United States, under the provisions of the Act of Congress approved April 26, 1940, public law No. 486, Seventy-sixth Congress – third session, and to expend from funds available to het board and not to exceed the sum of $10,000 in matching the funds so received of the United States, for said purpose.

Section 11. The state Forester hereby is authorized to employ assistants and personnel, to purchase equipment and supplies as shall be required to accomplish the purpose of this Act; also, to enter into and award any and all contracts in the name of the State Board of Forestry as are necessary for such control, destruction and eradication of the forest insect pests and forest tree diseases as herein stated.

Section 12. Sections 107-261 to 107-270, inclusive, O.C.L.A., and chapter 324, Oregon Laws 1941, and chapter 336, Oregon Laws 1945, are repealed; however, the repeal of said statutes shall not affect any obligation incurred on any suit or action pending under such statutes.

Section 13. This Act being necessary for the immediate preservation of the public peace, health and safety, an emergency is declared to exist, and this Act shall take effect upon its passage.

3.3.3 State of Washington – Cooperative Control of Forest Insects and Diseases

Washington Laws of 1951, Chapter 233; Approved March 19, 1951; 32nd Session of the Legislature.

An Act providing for cooperative control of forest insects and forest diseases between the state of Washington, federal government and/or private forest land owners; creating the forest insect and disease control fund of which the state treasurer shall be the custodian; making appropriations; and declaring and emergency.

Be It Enacted by the Legislature of the State of Washington:

Section 1. Forest insects and forest tree diseases which threaten the permanent timber production of the forest areas of the state of Washington are hereby declared to be a public nuisance.

Section 2. As used in this act: "Supervisor" means the supervisor of forestry; "Board" means the state forest board; "Owner" means and includes individuals, partnerships, corporations, and associations; "Agent" means the recognized legal representative, representatives, agent or agents for any owner; "Timberland" means any land on which there is a sufficient number of trees, standing or down, to constitute , in the judgment of the board, a forest insect or forest disease breeding ground of a nature to constitute a menace, injurious and dangerous to permanent forest growth in the district under consideration.

Section 3. This act shall be administered by the division of forestry under the guidance and approval of the state forest board.

Section 4. Every owner of timberland, or his agent, shall make every reasonable effort to control, destroy and eradicate such forest insect pests and forest tree diseases which threaten the existence of any stand of timber or provide for the same to be done on timberlands owned by him or under his control. In the event he fails, neglects, or is unable to accomplish such control, the action may be performed as provided for in this act.

Section 5. Whenever the supervisor finds timberlands threatened by infestations of forest insects or forest tree diseases, and if he finds that such infestation is of such character as to threaten destruction of timber stands, the supervisor shall with the approval of the board declare and certify an infestation control district and fix and declare the boundaries thereof, so as to definitely describe such district. Said district may include timberlands threatened by the infestation as well as those timberlands already infested.

Thereafter the supervisor shall at once serve written notice to all owners of timberlands or their agents within the said district to proceed under the provisions of this act without delay to control, destroy and eradicate the said forest insect pests or forest tree diseases as provided herein. The said notice may be made by personal service, or by mail addressed to the last known place or address of such owner or agent. Said notice shall list and describe the method or methods of action that will be acceptable to the board if the owner or agent elects to control, destroy and eradicate said insects or diseases on his own property.

Section 6. If the owner or agent so notified shall fail, refuse, neglect or is unable to comply with the requirements of said notice, within a period of thirty days after the date thereof, it shall be the duty of the supervisor or his agents, using such funds as have been, or hereafter may be, made available to proceed with the control, eradication, and destruction of such forest pests or forest tree diseases with or without the cooperation of the owner involved in a manner approved by the forest board.

Section 7. Upon the completion of the work directed, authorized and performed under the provisions of this act, the supervisor shall prepare a verified statement of the expenses necessarily incurred in performing the work of controlling, eradicating and destroying said forest insects or forest tree diseases. The balance of such expenses after deducting such amounts as may be contributed to the control costs by the state, by the federal government, or by any other agencies, companies, corporations, or individuals, shall be a lien to be prorated per acre upon the property, or the properties involved: Provided, That the amount of said lien shall not exceed twenty-five percent of the total costs incurred on such owner's lands including necessary buffer strips. Said lien shall be reported by the supervisor to the county assessor of the county in which said lands are situated, and shall be levied and collected with the next taxes on such lands in the same manner and with the same interest, penalty and cost charges as apply to ad valorem property taxes in this state: Provided further, Such report and levy shall be made only on commercial timberlands. The assessor shall extend the amounts on the assessment roll in a separate column, and the procedure provided by the law for the collection of taxes and delinquent taxes shall be applicable thereto, and, upon the collection thereof, the county treasurer shall repay the same to the supervisor to be applied to the expenses incurred in carrying out the provisions of this act.

Section 8. There is hereby created the forest insect and disease control fund of which the state treasurer shall be the custodian. The state treasurer shall keep an account of his records of said fun and all sums deposited therein and expended or withdrawn therefrom. Any sums placed in said fun shall be kept separate and apart from the funds of the state treasurer , and shall not be deemed to be a part of the state funds, but shall be pledged for the purpose of paying costs incurred for the control, eradication, and destruction of forest insect pests and forest diseases. No funds shall be expended for payment of said costs, until so authorized by the board.

Section 9. All moneys collected under the provisions of section 7, together with such moneys as may be appropriated by the legislature for the purposes of this act, by the federal government or by any owner or agent, shall be deposited by the supervisor in the forest insect and disease control fund, and the moneys therein hereby are made available to the board for the purposes of this act.
All unexpended balances remaining in said fund shall continue to be available for the purposes of this act and shall not revert to state general fund.

Section 10. Any money appropriated to the forest insect and disease control fund is hereby made available to the division of forestry for the purposes of this act.

Section 11. Every owner, and all owners or representatives, who upon receiving notice as provided in section 5 of this act, shall proceed and continue in good faith to control, eradicate and destroy said forest insects and forest tree diseases in accordance with standards established by the supervisor shall be exempt from the provisions hereof as to the lands upon which he or they are so proceeding.

Section 12. Whenever the board shall determine that insect control work within the designated district of infestation is no longer necessary or feasible, said board by resolution may dissolve said district.

Section 13. This act is necessary for the immediate preservation of the public peace, health and safety, the support of the state government and its existing public institutions, and shall take effect immediately.

3.3.4 Cooperative Forestry Assistance Act of 1978

COOPERATIVE FORESTRY ASSISTANCE ACT OF 1978
16 U.S.C. §§ 2101-2111, July 1, 1978, as amended 1990, 1991, 1992 and 1996.

Overview. *The Act authorizes the Secretary of Agriculture to establish a variety of cooperative programs to protect and manage nonfederal forest lands.*

Findings/Policy. *Congress found that because most of the nation's productive forest land is owned privately or by local and state government the capacity of the U.S. to produce renewable forest resources depends significantly on nonfederal land. Congress also made findings regarding the importance of: adequate supplies of timber and other forest resources; managed forest lands providing habitats for fish and wildlife; federal-state cooperation in forest fire protection; the recognition that forest landowners are being pressured to convert their forest land to development and other purposes; long-term land management and stewardship of privately held forest resources. The purpose of the Act is to authorize the Secretary of Agriculture (Secretary) to assist in establishing a cooperative federal, state and local forest stewardship program for management of nonfederal forest lands and achieving a number of goals for the use and protection of forest lands. Congress declared that it is in the national interest for the Secretary to cooperate with state officials, nongovernmental organizations and the private sector in implementing federal programs affecting nonfederal forest lands. § 2101.*

Rural Forestry Assistance. *The Act authorizes the Secretary to provide financial, technical, educational and related assistance to state foresters or equivalent officials and state extension directors to enable these officials to provide information and advice to private forest landowners and managers, vendors, forest resource operators and professionals, public agencies and individuals to carry out activities consistent with the purposes of the Act, including: protecting and restoring forest lands; identifying, protecting, and enhancing wildlife and fish species and their habitats; implementing forest management technologies; selecting, producing and marketing alternative forest crops and products; protecting forest land from damage by fire, insects, disease and weather; managing land to balance the use of forest resources near urban and community areas; managing recreational forest land resources; protecting the aesthetic character of forest lands; protecting forest land from conversion to other uses; managing the resources of forest land.*

The Secretary is authorized to provide financial, technical and related assistance to: develop genetically improved tree seeds; develop field arboretums, greenhouses and nurseries; procure, produce and distribute tree seeds and trees; plant tree seeds and seedlings on nonfederal forest lands; implement measures on nonfederal forest lands to increase the quantity and improve the quality of trees and fish and wildlife habitat; protect and improve soil fertility. The Secretary must cooperate with other federal, state and local agencies, universities and the private sector in these tasks. Congress authorized to be appropriated sums necessary to carry out these provisions. § 2102.

Forestry Incentives Program. *The Act authorizes the Secretary to develop and implement a forestry incentives program to encourage the development, management and protection of nonindustrial private forest lands. Landowners with 1,000 acres or less are eligible for federal cost sharing. The Secretary may approve cost sharing with landowners owning up to 5,000 acres if the Secretary determines that significant public benefits will accrue. Congress authorized to be appropriated sums necessary to carry out this program for fiscal years 1996 through 2002. § 2103.*

Forest Stewardship Program. *The Secretary, in consultation with state foresters or equivalent officials, must establish a forest stewardship program to encourage long-term stewardship of nonindustrial private forest lands by assisting landowners in using federal, state and private management expertise and assistance programs. The Secretary must provide financial, technical, educational and related assistance that will help landowners understand and evaluate alternative actions they might take, including: managing and enhancing the productivity of timber, fish and wildlife habitat, water quality, wetlands, recreational resources, and the aesthetic value of forest lands; investing in practices to*

protect, maintain and enhance these resources; using practices to ensure the long-term productivity of forest resources and protection of environmental benefits; protecting forests from damage by fire, insects, disease and weather. Congress authorized to be appropriated $25,000,000 for each fiscal year 1991-95 and sums necessary thereafter to carry out this program. Congress required the Secretary to establish a stewardship incentive program, including federal cost sharing, within the Forest Service to meet the goals of the forest stewardship program and authorized to be appropriated $100,000,000 for each fiscal year 1991-95 and sums necessary thereafter. §§ 2103a- 2103b.

Forest Legacy Program. *The Act requires the Secretary to establish a forest legacy program to ascertain and protect environmentally important forest areas that are threatened by conversion to non-forest uses, to promote forest land protection and other conservation opportunities through conservation easements and other mechanisms, and to protect important scenic, cultural, fish, wildlife and recreational resources, riparian areas and other ecological values. The Secretary may provide state grants for this program. Congress authorized to be appropriated sums necessary to carry out this program. § 2103c.*

Forest Health Protection. *The Act authorizes the Secretary to protect trees, forests, wood products and stored wood on National Forest System land and other lands in the U.S. from natural and human threats. Congress authorized to be appropriated annually sums to carry out the general provisions of this program, and $10,000,000 annually to carry out a program of integrated pest management. § 2104.*

Urban and Community Forestry Assistance. *Based on findings on the importance of trees in urban and community settings, Congress authorized the Secretary to provide financial, technical and related assistance to encourage states to engage in cooperative efforts to plan urban forestry programs and to use trees in a variety of urban areas. The Secretary must establish a cost-share program to support urban and community forestry projects. Congress authorized to be appropriated $30,000,000 for each fiscal year 1991-95 and sums necessary thereafter to implement this program. § 2105.*

Rural Fire Prevention and Control. *Reciting the importance of fire prevention and control in rural communities, Congress authorized the Secretary to cooperate with state foresters or equivalent officials in developing methods for fire protection on rural lands and in rural communities, and to provide financial, technical and related assistance for fire prevention and training activities. Congress made various appropriations to support these efforts. Congress also authorized the Secretary to provide assistance, either through reimbursement or providing tree seedlings, to eligible landowners whose commercial tree stand is at least 35 percent destroyed through weather or fire. §§ 2106-2106a.*

Assistance to States. *To achieve maximum effectiveness of the Act's programs, Congress authorized the Secretary to provide financial, technical and related assistance to state foresters or equivalent officials to develop stronger and more efficient state organizations that will fulfill better their responsibilities for protection and management of nonfederal forest lands. The Secretary's assistance may include organization management, program planning, budget and fiscal services, personnel training and management, information services and recordkeeping. Assistance may be provided only upon state request. The Secretary also is authorized to provide assistance with collection of forest resources data and to aid in technology implementation. Congress authorized to be appropriated sums necessary to carry out these provisions. § 2107.*

General Provisions. *To provide flexibility in the Act's funding activities, upon state request the Secretary may consolidate the annual financial assistance payments to states made under the Act. In implementing the Act the Secretary must work cooperatively with state officials and coordinate programs under the Act with related programs. The Secretary may issue rules and regulations to carry out the Act. §§ 2108-2109.*

Appendix 4
Federal and state cooperative agreements

Up until 2015, one cooperative agreement was made between the USFS and ODF and another between the USFS and WDNR. In general, these agreements outlined aerial survey cost-sharing, equipment, and product delivery. Traditionally one state and one federal employee are each required to be in the airplane to conduct aerial surveys. The cost-share agreements with each state differ regarding equipment and survey funding.

In 2015, after many years of effort, the first three-way master challenge cost share agreement between ODF, WDNR, and USFS was made. This five year agreement allows ODF and WDNR resources to be used in both states. The cost-sharing and other state-specific details are covered in individual Supplemental Project Agreements to the master agreement, included below. The three-way master agreement was a result of efforts by Iral Ragenovich (Regional Entomologist; USFS), Sheila Walker (Grants Management Specialist; USFS), Ben Smith (Aerial Survey Program Manager; USFS), Karen Ripley (Program Manager, WDNR); and James Cathcart (Program Manager, ODF).

2015: Master Challenge Cost Share Agreement; FS agreement 15-CS-11062765-701; Cooperator agreement IAA 15-148.

Excerpts:

> **Background:** *The Cooperative Forestry Assistance Act of 1978 stipulates that the Secretary of Agriculture, in cooperation with Foresters, conduct surveys to detect and appraise insect infestations and disease conditions and man-made stresses affecting trees and establish a monitoring system throughout the forests of the United States. Statewide aerial surveys for detecting insect, disease, or other forest health related damage or impacts on forested lands in the Pacific Northwest Region, which includes the States of Oregon and Washington and some of northern California, have been conducted jointly by the U.S. Forest Service and the Cooperators since 1948. Over the years, the survey has evolved; it has become most efficient and cost-effective for the U.S. Forest Service and the Cooperators to conduct these surveys together in one survey of all federal, state, and private forested lands. A survey crew in most instances, has consisted of two aerial observers (one Federal and one from the respective State Agency), a survey aircraft, and a pilot.*
>
> **Statement of Mutual Benefits and Interests:** *It is mutually beneficial to enter into this agreement to establish a framework for the development of individual Supplemental Project Agreements (SPAs) (see 2.3.1 and 2.3.2 for details) for the parties [ODF, WDNR, USFS] to work together on projects to accomplish their mutual goals.*
>
> *…*
>
> *The Cooperators [ODF and DNR] & the Forest Service may share personnel resources under any potential SPA. At times, an employee from either party may participate as a surveyor on an aerial survey event which may occur outside of his or her jurisdiction (state)….*

4.1 Oregon supplemental project agreement

2016:
Attachment A - Annual Operating Plan for 15-CS-11062765-703

PURPOSE:

The purpose of this operating plan is to document the cooperation between the parties to cooperatively conduct statewide aerial surveys to assess damage on forested lands caused by insects and disease. These surveys are an important tool for gathering information about the status of forest disturbance agents and contributing to the protection, development, enhancement and improvement of Federal, State, and private forest lands in Oregon and Washington.

ODF SHALL:

1. *Meet with a U.S. Forest Service Representative at a mutually agreed upon date and time, but not later than May 1, to determine the survey protocol for this year's survey.*

2. *Will cover the cost for 100 percent of the survey costs for 40 percent of the lands surveyed, because forested lands surveyed in Oregon are 40 percent State and private ownership; see attached map.*

3. *Arrange for a trained observer, pilot, and State Partenavia Observer aircraft (9000V) or other U.S. Forest Service approved aircraft and/or pilot as necessary for aerial survey.*

4. *Identify the number of electronic and paper map copies needed by ODF.*

5. *Provide personnel to assist in processing data and preparing final maps and data, if available.*

THE U.S. FOREST SERVICE SHALL:

1. *Meet with the ODF Representative at a mutually agreed upon date and time, but not later than May 1, to determine the survey protocol for this year's survey.*

2. *Pay 100 percent of the survey costs for 60 percent of the lands, because Forested lands surveyed in Oregon are 60 percent Federal; see attached map. The U.S. Forest Service reserves the right to terminate the Supplemental Project Agreement when allocated funds are exhausted.*

3. *Arrange for a trained observer and flight maps upon which the aerial observers record their findings.*

4. *Digitize the aerial survey data and compile it into maps and tables. Data will be provided to ODF in electronic files, tables and paper map copies as soon as possible.*

5. *Make any and all arrangements for the survey and be responsible for the reimbursement of any and all costs directly associated with the U.S. Forest Service share of the survey. This includes scheduling for the use of FS Aero Commander 147Z for the general overview survey.*

6. *Have the legal authority to enter into this instrument, and the institutional, managerial and financial capability (including funds sufficient to pay Federal share of project costs) to ensure proper planning, management, and completion of the project.*

Aircraft usage: Current plan is to use 9000V, ODF Partenavia Observer, for the lower elevation surveys on the west side of the State and the Willamette Valley. This is approximately 40 percent of the lands included in the aerial survey. For the higher elevation forests in southern parts of the State and eastern Oregon, the plan is to use 147Z, USFS Aero Commander, based in Redmond, Oregon. This area comprises approximately 60 percent of the lands surveyed. If 9000V is used for survey in Washington, ODF will be reimbursed for actual costs and travel expenses.

Aircraft	Flight Rate
9000V – ODF Partenavia Observer	$500.00/hour
357PN – WAFW Turbo Partenavia	$650.00/hour
166Z – USFS Cessna TU206	$270.00/hour
147Z – USFS Aero Commander	$875.00/hour
N758 – USFWS Kodiak	$675.00/hour

Flight planning: ODF and U.S. Forest Service flight coordinators are responsible for monitoring the percentage of areas flown by each aircraft. Operations are planned to maintain the 60/40 coverage during survey season.

Accounting: In instances where the 60/40 split is not achieved, funds will be transferred to the appropriate agency: If the ODF covers more than their 40 percent, they will be compensated by the U.S. Forest Service for the flight hours to survey the additional area. The U.S. Forest Service has obligated up to $20,400 to cover the possibility of this scenario (of which approximately $14,000 remains after the 2015 survey season).

If the U.S. Forest Service covers more than their 60 percent, they will be compensated by the ODF for the flight hours to survey the additional area. Reimbursement rates will equal those in the financial plan. Before work over and above the 60 percent begins, signatory officials of each party will concur. A separate Supplemental Project Agreement will be executed within 30 days.

If the 60/40 split is met, there is no need to transfer funds.

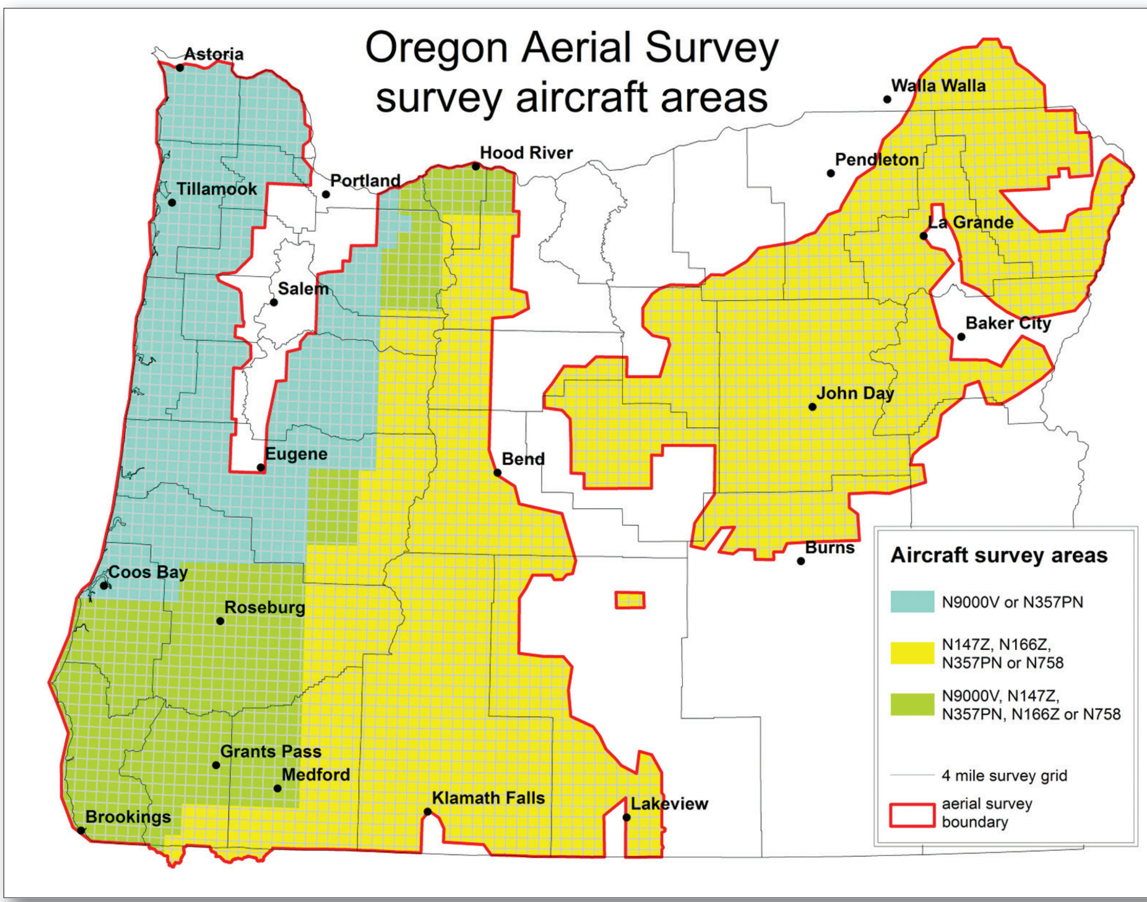


Figure A3. *The forested area surveyed in Oregon is 60 percent Federal ownership and 40 percent State and privately owned. Areas where the ODF Partenavia can be used for survey is also approximately 40 percent of the total survey area. ODF will be responsible for 100 percent the costs for surveying 40 percent of the area. The U.S. Forest Service will pay 100 percent of the costs on 60 percent of the survey area. Areas where 9000V can be flown with Federal observers onboard is shown in blue and green on the above map.*

4.2 Washington supplemental project agreement

2016:

Attachment A - Annual Operating plan for 15-CS-1106765-703

PURPOSE:

The purpose of this operating plan is to document the cooperation between the parties to cooperatively conduct statewide aerial surveys to assess damage on forested lands caused by insects and disease. These surveys are an important tool for gathering information about the status of forest disturbance agents and contributing to the protection, development, enhancement and improvement of Federal, State, and private forest lands in Oregon and Washington.

WDNR SHALL:

1. *Meet with a U.S. Forest Service Representative at a mutually agreed upon date and time, but not later than May 1, to determine the survey protocol and schedule for this year's survey.*

2. *Cover the cost for 100 percent of the survey costs for 50 percent of the lands surveyed. Because forested lands surveyed in Washington are 50 percent State and private ownership; see attached map.*

3. *Arrange for a trained observer, pilot, and Washington Department of Fish and Wildlife (WDFW) Turbo Partenavia P68 aircraft (357PN) or other U.S. Forest Service approved aircraft and/or pilot as necessary for aerial survey.*

4. *Identify the number of electronic and paper map copies needed by WDNR.*

5. *Provide personnel to assist in processing data and preparing final maps and data.*

THE U.S. FOREST SERVICE SHALL:

1. *Meet with the WDNR Representative at a mutually agreed upon date and time, but not later than May 1, to determine the survey protocol for this year's survey.*

2. *Pay 100 percent of the survey costs for 50 percent of the lands, because forested lands surveyed in Washington are 50 percent Federally owned; see attached map. The U.S. Forest Service reserves the right to terminate the Supplemental Project Agreement when allocated funds are exhausted.*

3. *Arrange for a trained observer and flight maps upon which the aerial observers record their findings.*

4. *Digitize the aerial survey data and compile it into maps and tables. Data will be provided to WDNR in electronic files, tables and paper map copies as soon as possible.*

5. *Make any and all arrangements for the survey and be responsible for the reimbursement of any and all costs directly associated with the U.S. Forest Service share of the survey. This includes scheduling for the use of FS Aero Commander 147Z or other suitable aircraft for the general overview survey if needed.*

6. *Have the legal authority to enter into this instrument, and the institutional, managerial and financial capability (including funds sufficient to pay Federal share of project costs) to ensure proper planning, management, and completion of the project.*

Aircraft usage: Current plan is to use 357PN, WDFW Partenavia Turbo P68, for all surveys in Washington. This will be accomplished through an agreement between WDNR and WDFW for the use of the aircraft July – September. The U.S.

Forest Service will be responsible for reimbursing WDNR for 50 percent of the costs associated with using this aircraft and pilot. If 357 PN is unavailable for any reason a suitable replacement can be used. Examples of suitable aircraft are listed below.

Aircraft	*Flight Rate*
9000V – ODF Partenavia Observer	*$500.00/hour*
357PN – WDFW Turbo Partenavia	*$675.00/hour*
166Z – USFS Cessna TU206	*$285.00/hour*
147Z – USFS Aero Commander	*$875.00/hour*
N758 – USFWS Kodiak	*$675.00/hour*

Flight planning: WDNR and U.S. Forest Service flight coordinators are responsible for recording flight hours during the survey season, either Hobbs meter or clock hours.

Accounting: WDNR will be responsible for paying WDFW for the use of 357 PN and pilot. The U.S. Forest Service will compensate WDNR for 50 percent of the costs associated with this survey. The amount will be determined at the end of the season, when the bill from WDFW is received.

If the U.S. Forest Service arranges for and pays for a replacement aircraft, this cost will be subtracted from the U.S. Forest Service's share of the WDFW bill.

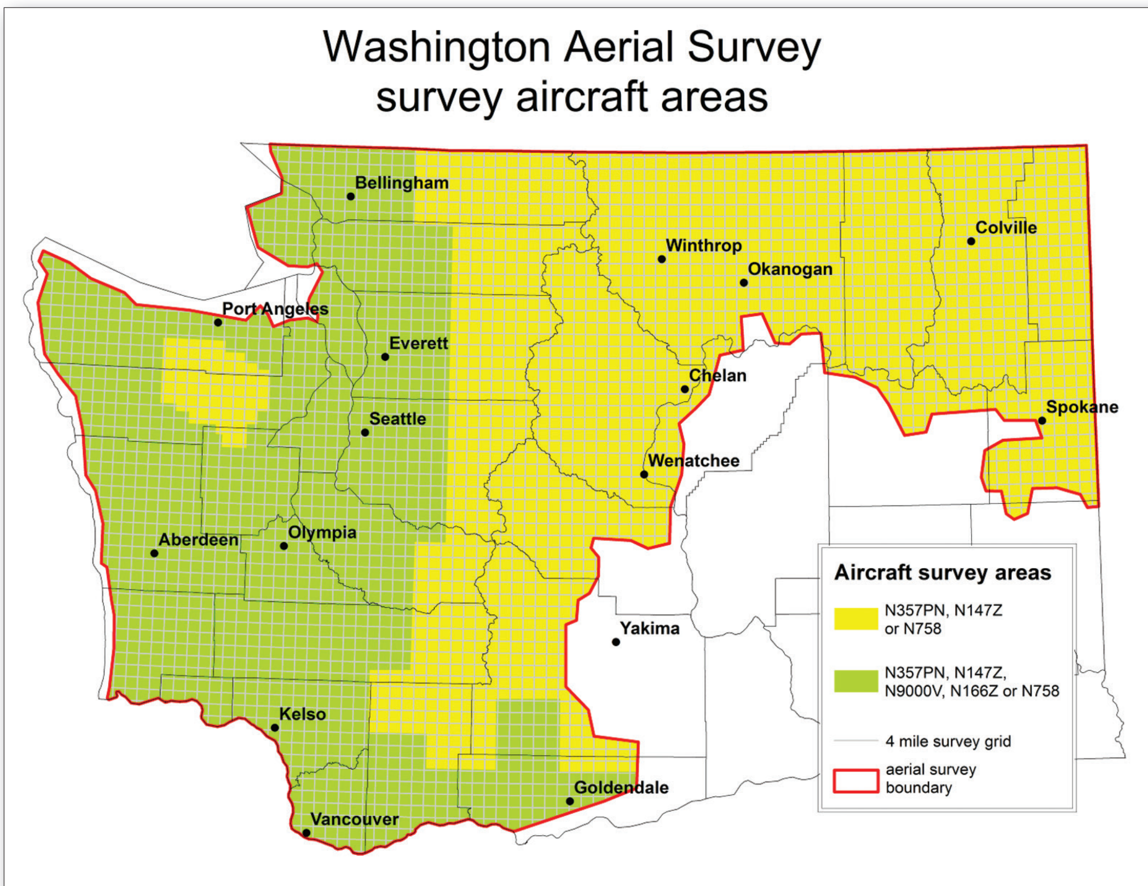


Figure A4. *The forested area surveyed in Washington is 50 percent Federal ownership and 50 percent State and privately owned. The aircraft selected for the survey, 357PN is approved to conduct surveys statewide. Areas in yellow represent higher elevations where higher performing aircraft should be used. The green areas are lower elevation areas where, if needed, a lower performing, suitable aircraft could be substituted. The green areas are also areas where Federal observers are allowed to fly in the ODF Partenavia Observer (9000V). If 9000V is used in WA for survey, the full cost will be paid by the U.S. Forest Service. This amount will be deducted from the amount the U.S. Forest Service would pay to WDNR for aircraft acquisition.*

Appendix 5
Mission planning and safety

The aviation and safety requirements of Fire and Aviation Management (FAM) and Forest Health Protection (FHP) programs are similar. FHP requirements tier to many of the well-established safety procedures, policies, and manuals implemented by FAM. When available, pilots and planes are sometimes provided by the FAM organization to help conduct surveys. Dispatch centers around the region provide required flight-following to track airplanes and ensure the safety of the survey crews.

But during active fires the priority for air space and dispatch support go to fire suppression. If there is a fire in Oregon and Washington between July and September, chances are that an insect and disease survey plane is in the air somewhere else in the region. Operating as a very small 'shadow' organization, each week the two survey crews stage themselves at various locations (one crew in each state) based on weather, smoke, aircraft and pilot availability, available dispatch flight-following support, and temporary flight restrictions (TFRs) around the operational airspace above active fires. This weekly positioning is often a complex and predictive analysis in an attempt to 1) get the most area flown with the least amount of down-time; 2) stay as far away from fires as possible; and 3) assure that the required resources, weather, and air space are available. Survey options become tight in late August and September, when fires are often very active and the areas left to survey become increasingly limited.

5.1 Mission planning

Surveys in Oregon and Washington are organized by state. In Oregon, the overview survey currently consists of two separate surveys. The bear survey is generally flown in June, with the regular overview survey flown July-Sept. Currently, in Oregon, the bear and overview surveys are combined to create the annual insect and disease survey dataset. Special surveys, while outside the scope of this report, can include Sudden Oak Death (SOD), Swiss Needle Cast, and Pandora Moth among others.

In Washington the overview survey is generally conducted from July-September. Special surveys for specific agents may be flown outside this window.

The following summaries provide specific mission-related details for each of the surveys that contribute to the annual insect and disease survey dataset.

5.1.1 Oregon bear survey, 2016

Oregon Bear Aerial Survey
Oregon Aerial Survey Operations Plan and Reference Guide
Prepared by: Robert Schroeter
May 3, 2016

The following reference guide outlines the general operations plans for the bear aerial survey conducted in Oregon. Included is information regarding how, where and when the aerial surveys are typically flown, grid and flight pattern, survey flight altitude, aircraft and airports used, dispatch offices contacted and used for flight following along with other considerations pertinent to the survey being conducted.

How and where flown:
Typically flown in NW Oregon from the Oregon coast to the foothills of the Cascades and from the Columbia River down to just south of Coos Bay and just north of Roseburg. The Willamette Valley is typically not flown … as it is primarily non-forested agricultural lands.

Timing of survey:
Typically flown during the month of June but has been flown from a range of dates from late May to late July due to weather conditions or signature development.

Grid and flight pattern:
Flown on a four mile grid with each observer mapping at least two miles out on each side of the aircraft. There are two different four mile grids used depending on whether it is an even or an odd numbered survey year. The difference between the two grids is that the odd year grid is offset by two miles to the north and by two miles to the east from the even year grid. The flight lines are typically flown in a north/south orientation following the natural terrain characteristics of the Oregon Coast and Cascade mountains. Flights usually originate and end for the day in Salem so flight lines typically head west out towards the coast or east out towards the cascades from the Salem area and then head north and south paralleling the coast or cascades.

Flight altitudes:
Typically flown at a survey altitude of 2000 to 2500 feet AGL. At this survey altitude aerial observers are able to see the bear and other mortality signatures easily and yet still be able to see out at least two miles from the aircraft to observe and map the full extent of the bear survey grid.

Flight planning:
A full day typically consists of two flight legs usually one in the morning and one in the afternoon. The typical length/duration of flights legs usually average 2 ½ to 3 hours with a break between the two legs to allow for refueling/surveyor and pilot breaks.
Ideal survey time frame is from 9AM to 3PM due to sun angle/shadows/best lighting. Since survey occurs during Daylight Savings time the actual ideal survey time frame is 10AM to 4PM. This usually translates into a take-off time of 9AM-9:30AM, a lunch/refueling stop at 12:30PM and a landing at the end of the day at 4:30PM-5PM.

Weather conditions:
Survey can be conducted in range of weather conditions with clear sunny days tending to be the preferred conditions. Overcast days are also acceptable as long as the cloud layer is not too thick to block the sunlight appreciable and that the cloud layer bases are high enough to fly the survey at 2500 feet AGL without any mountain obscuration. Overcast days, if they are bright enough, are good in the sense that the overcast cloud layer tends to eliminate any shadows and gives nice even lighting on the survey terrain. Lots of puffy cumulus clouds with sunbreaks tend to create less than ideal survey conditions as it creates bright sunny spots and deep shadows on the survey terrain which makes it more difficult for the observers to see bear and other mortality signatures.

Temperatures are typically are less than 80 degrees Fahrenheit (which translate into ISA, ISA+5 or ISA+10 conditions). So temperature typically isn't a factor when doing the bear aerial survey. Typically all surveys are flown in ISA+20 or ISA+25 conditions or cooler; it is best to avoid flying survey when it is ISA+30 or hotter temperatures as aircraft performance decreases.

Aircraft:
N9000V – ODF Partenavia Observer (primary aircraft for survey)
N357PN – WA FW turbo Partenavia (secondary aircraft used for survey through ODF agreement with WA F&W).
Typical aircraft speed when flying survey using N9000V and N357PN is 100 to 110 knots.

Airports:
Salem is the base of operation for all flights typically for the bear aerial survey as the ODF hangar is located there and it is a full service airport.

Other full service airports used for lunch/refueling/breaks during the Bear survey include the following: Astoria, Corvallis, Hillsboro, McMinnville, Newport, North Bend (Coos Bay), Roseburg, Scappoose, Tillamook and Troutdale.

Other self-serve airports used during the bear survey may include: Cottage Grove, Creswell and Florence
An airport runway length of at least 2900 feet is the minimum preferred length for landing/takeoff when using either aircraft N9000V or N357PN.

Dispatch offices and flight following:
Automated flight following (AFF) can either be done with Federal or State dispatch offices and include the following:
For Federal Interagency the main dispatch offices to AFF with are: Coastal Valley ICC, Eugene ICC and Columbia Cascade ICC.

Coastal Valley ICC is used for the portion of the survey in the Coast Range. Their repeaters can cover the coastal area from Astoria on the north down to Coos Bay. The National Flight Following (NFF) frequency isn't available for flight following use but three or four of the dispatch zone repeaters can be used instead (and will need to be programmed into the aircraft radio - preferably before the flight). When calling dispatch before the beginning of the survey flight, confirm with dispatch the repeaters you intend to use for radio contact.

Eugene ICC is used for the portion of the survey in the Cascades south of Detroit Lakes and at the southern end of the Willamette Valley south of Eugene.

Columbia Cascade ICC is used for portion of the survey in the Cascades north of Detroit Lakes.

Both Eugene ICC and Columbia Cascade ICC can be used for AFF with the National Flight Following (NFF) frequency.
The Federal Interagency dispatch offices also have and use a dispatcher Gmail account that all their dispatchers have access to so you can also email each of the dispatch offices a map of your intended flight plan for the day if you wish. Doing so tends to simplify the calls that you make to the dispatch offices in the morning to arrange for flight following.

For State dispatch offices the main flight following office is the ODF Salem Coordination Center in Salem. They would most likely have dispatchers available to do AFF with the other ODF field offices providing the radio contact with a district dispatch radio frequency when flying survey over their respective dispatch areas.

One consideration with flight following during the bear survey is that it is early in the year before the start of fire season so the Federal dispatch offices typically close by 5PM. So it good to consult with dispatch as to their closing time and plan on finishing the survey flight for the day before dispatch closes.

Likewise with the State dispatch offices, since fire season typically hasn't begun, most of the State dispatch offices aren't likely to be fully staffed and may not have personnel available to do flight following and also tend to close by 5PM.[324]

[324]Schroeter, R. 2016. Oregon bear aerial survey operations plan and reference guide. 11 p. R6 aerial survey program files. Sandy, OR.

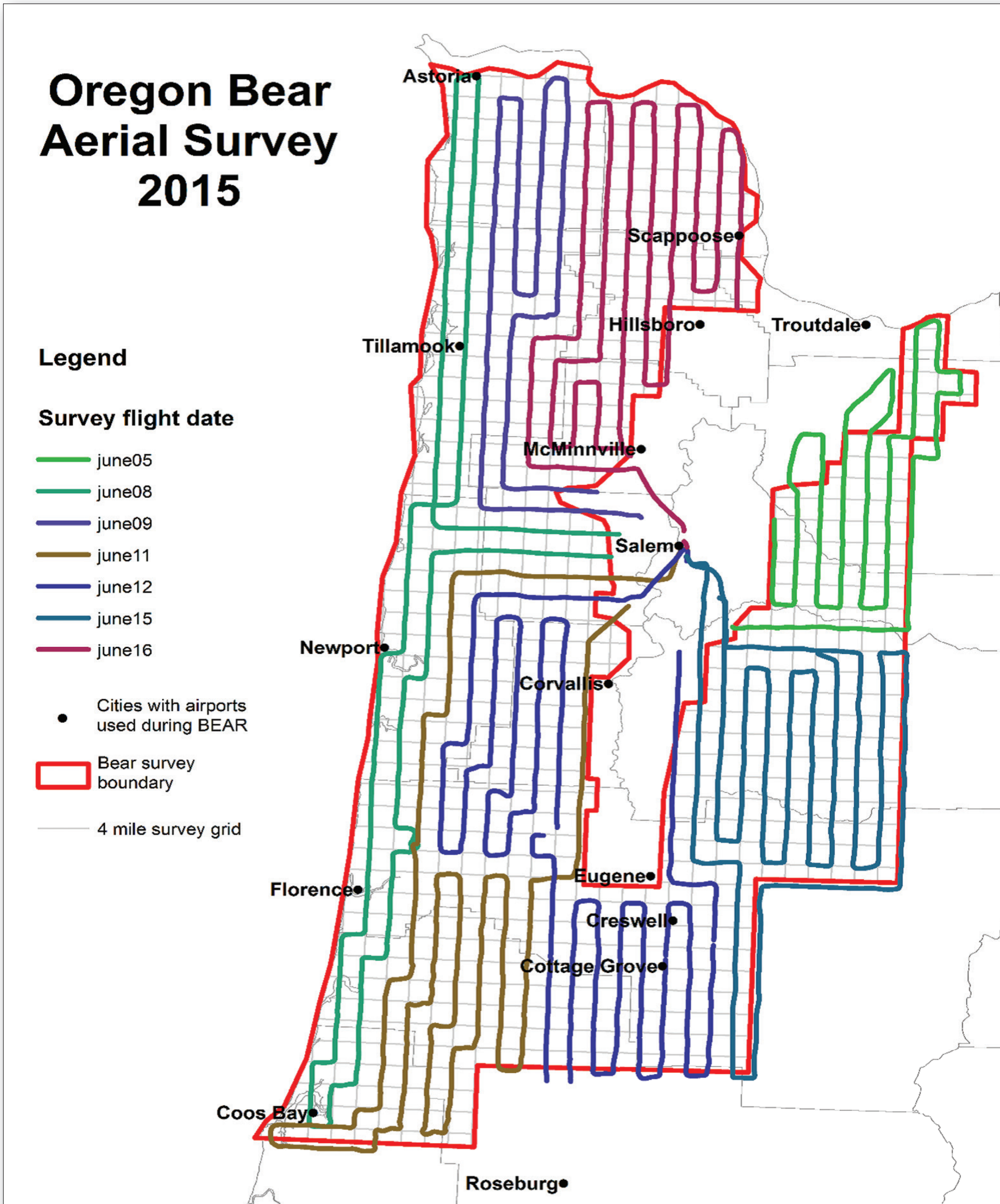


Figure A5. *Area covered by Oregon bear survey, 2015. Prepared by Robert Schroeter.*

5.1.2 Oregon general overview survey, 2016

General Overview Aerial Survey
Oregon Aerial Survey Operations Plan and Reference Guide
Prepared by: Robert Schroeter
April 5, 2016

The following reference guide outlines the general operations plans for the General Overview aerial survey conducted in Oregon. Included is information regarding how, where and when the aerial surveys are typically flown, grid and flight pattern, survey flight altitude, aircraft and airports used, dispatch offices contacted and used for flight following along with other considerations pertinent to the survey being conducted.

How and where flown:
Typically flown over all the forested areas in Oregon except for the area covered by the Bear survey. This would include SW Oregon, the Oregon Cascades, South Central, Central and NE Oregon. The SE portion of Washington is also typically flown as part of the Oregon General Overview aerial survey as it tends to be more efficient to fly the aerial survey from Oregon than from Washington.

Timing of survey:
Typically flown during the months of July, August and September but it has been flown from a range of dates from late June to late October due to weather conditions or signature development.

Grid and flight pattern:
Flown on a four mile grid with each observer mapping at least two miles out on each side of the aircraft. There are two different four mile grids used depending on whether it is an even or an odd numbered survey year. The odd year grid is offset by two miles to the north and by two miles to the east from the even year grid.

The flight lines are typically flown in a north/south or east/west orientation depending on the natural terrain characteristics.

Flights in SW Oregon usually originate and end for the day in Medford. Typically the coast and Coos County is flown whenever that area is free from fog so flight lines out of Medford typically head to the coast where survey lines are usually flown in north/south orientation working from the coast inland. Inland areas can be flown either in a north/south or east/west orientation.

Flights in the Cascades, Siskiyou Mountains, South Central, Central and NE Oregon usually originate and end for the day in Redmond except for the very northern portion of the Cascades (that are typically 5000 feet or less in elevation) that are flown out of Salem. The Cascades are typically flown in a north/south orientation, the Siskiyou Mountains in an east/west orientation, while areas in South Central, Central and NE Oregon are flown in either a north/south or east/west orientation.

Flight altitudes:
Typically flown at an altitude of 2000 to 2500 feet AGL. At this altitude aerial observers are able to see the insect and disease mortality signatures easily and yet still be able to see out at least two miles from the aircraft to observe and map the full extent of the General Overview survey grid.

Flight planning:
A full day of the General Overview survey typically consists of two flight legs usually one in the morning and one in the afternoon. The typical length/duration of flights legs usually average 2 ½ to 3 hours with a break between the two legs to allow for refueling/surveyor and pilot breaks.

Ideal survey time frame is from 9 AM to 3 PM due to sun angle/shadows/best lighting. Since survey occurs during Daylight Savings time the actual ideal survey time frame is 10AM to 4PM. This usually translates into a take-off time of 9AM-9:30 AM, a lunch/refueling stop at 12:30 PM and a landing at the end of the day at 4:30 PM-5 PM.

Weather conditions:
The General Overview survey can be conducted in range of weather conditions with clear sunny days tending to be the preferred conditions. Overcast days are also acceptable as long as the cloud layer is not too thick to block the sunlight appreciable and that the cloud layer bases are high enough to fly the survey at 2500 feet AGL without any mountain obscuration. Overcast days, if they are bright enough, are good in the sense that the overcast cloud layer tends to eliminate any shadows and gives nice even lighting on the survey terrain. Lots of puffy cumulus clouds with sunbreaks tend to create less than ideal survey conditions as it creates bright sunny spots and deep shadows on the survey terrain which makes it more difficult for the aerial observers doing the sketch mapping to see the insect and disease mortality signatures.

Temperatures typically are less than 90 degrees Fahrenheit (which translate into ISA+25 or less conditions). So temperature typically isn't a factor when doing the General Overview aerial survey unless the temperature gets above 95 to 100 degrees Fahrenheit. Typically all surveys are flown in ISA+20 or ISA+25 conditions or cooler. It is best to avoid flying survey when it is ISA+30 or hotter temperatures as aircraft performance decreases.

Aircraft:
For the General Overview survey the following aircraft are typically used.
N9000V – ODF Partenavia Observer (primary aircraft for survey in SW Oregon and N Cascades where terrain is generally 5000 feet or less in elevation).
N357PN – WDFW turbo Partenavia (secondary aircraft used for survey through ODF agreement with WDFW. Aircraft can be used for survey though-out Oregon).
N147Z – USFS Aero Commander (primary aircraft for survey in the Cascades, Siskiyou Mtns, South Central, Central and NE Oregon where terrain is generally above 5000 feet in elevation. Aircraft can be used for survey through-out Oregon).
Typical aircraft speed when flying survey using N9000V and N357PN is 100 to 110 knots and when flying survey using N147Z is 120 knots.

Airports:
Salem is the base of operation for all flights typically in the N Cascades (where terrain is generally 5000 feet or less in elevation) and is a full service airport.

Medford is the base of operation for all flights typically in SW Oregon and is a full service airport.

Redmond is the base of operation for all flights typically in the Cascades, Siskiyou Mtns, South Central, Central and NE Oregon as the USFS hangar is located there and it is a full service airport.

Other full service airports that are typically used for lunch/refueling/breaks include: Bend, Klamath Falls, La Grande, Lewiston, Madras, North Bend (Coos Bay), Pendleton, Roseburg, The Dalles, Troutdale, and Walla Walla.

Other self-serve airports that have been used during the General Overview aerial survey include: Baker City, Bandon, Brookings, Burns, Cottage Grove, Creswell, Gold Beach, Grants Pass, Hood River, John Day, Joseph, Lakeview, Prineville and Sunriver.

An airport runway length of at least 2900 feet is the minimum preferred length for landing/takeoff when using either aircraft N9000V or N357PN for flying the General Overview aerial survey.

An airport runway length of at least 3500 feet is the minimum preferred length for landing/takeoff when using N147Z for flying the General Overview aerial survey.

Dispatch offices and flight following:
Flight following (AFF) can either be done with Federal or State dispatch offices and include the following:

For Federal Interagency the main dispatch offices to AFF with are Rogue Valley ICC, Umpqua NF, Eugene ICC, Columbia Cascade ICC, Central Oregon ICC, Lakeview IFC, Burns ICC, John Day ICC and Blue Mountain ICC. All of the above dispatch offices utilize the National Flight following (NFF) frequency. The Lakeview IFC also utilizes a local flight following frequency.

Rogue Valley ICC and Umpqua NF are used for the SW Oregon portion of the General Overview aerial survey.

Columbia Cascade ICC, Eugene ICC, Central Oregon ICC and Lakeview IFC are used for the Cascades and South Central Oregon portion of the General Overview aerial survey.

Central Oregon ICC, John Day ICC, Burns ICC and Blue Mountain ICC are used for the Central and NE Oregon portions of the General Overview aerial survey.

The Federal Interagency dispatch offices also use a dispatcher Gmail account that all their dispatchers have access to so you can also email each of the dispatch offices a map of your intended flight plan for the day if you wish. Doing so tends to simplify the calls that you make to the dispatch offices in the morning to arrange for flight following.

State dispatch offices in SW Oregon are: ODF SW Oregon offices in Medford and Grants Pass, Coos FPA office in Coos Bay and Roseburg FPA office in Roseburg. They would most likely have dispatchers available to do AFF and provide radio contact with a district dispatch radio frequency when flying survey over their respective dispatch areas.

State dispatch offices east of the Cascades are typically part of the Federal Interagency dispatch offices for the most part and hence flight following can be done through the Federal Interagency dispatch office. The benefit of doing so enables the use of the NFF frequency with AFF.

One consideration with flight following during the General Overview aerial survey is that the survey usually occurs during fire season so a dispatch office may have limited resources available for doing flight following if they have a lot of fire activity going on in their dispatch zone. In those cases it may be possible to use another dispatch office that may not be as busy for your flight following needs.[325]

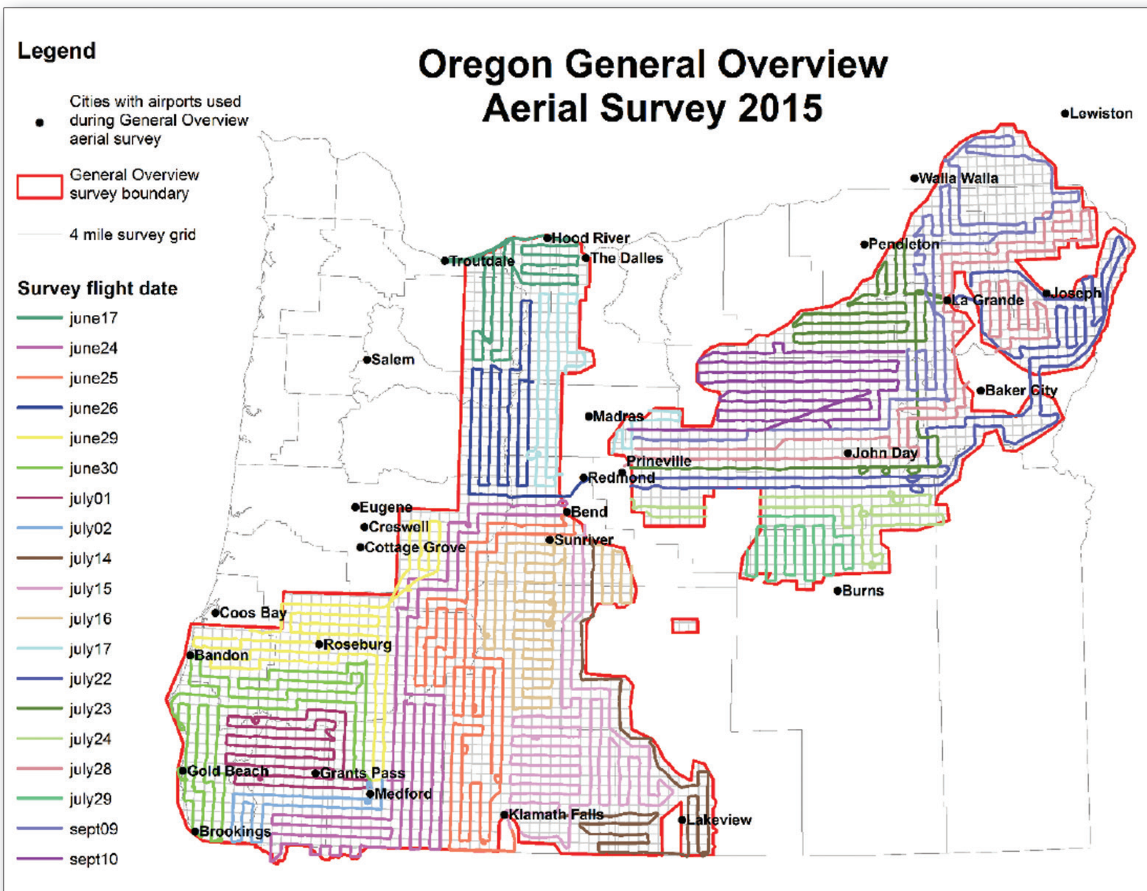


Figure A6. *Area covered by the Oregon general overview survey, 2015. Prepared by Robert Schroeter.*

[325]Schroeter, R. 2016. General overview aerial survey, Oregon aerial survey operations plan and reference guide. 11 p. R6 aerial survey program files. Sandy, OR.

5.1.3 Washington general overview survey, 2016

General Overview Aerial Survey
Washington Aerial Survey Operations Plan and Reference Guide
Prepared by: Justin Hof
April 9th, 2016

The following reference guide outlines the general operations plans for the General Overview aerial survey conducted in Washington.

How and where flown:
The General Overview aerial survey is typically flown over all the forested areas in Washington. This includes: The Washington coast, the Olympic Mountains, Cascade Mountains and North Eastern Washington.

Timing of survey:
The survey is typically flown during the months of July, August and September but has been flown from a range of dates from late June to late October due to weather conditions or signature development.

Grid and flight pattern:
The survey is flown on a four mile grid with each observer mapping at least two miles out on each side of the aircraft. There are two different four mile grids used depending on whether it is an even or an odd numbered survey year. The difference between the two grids is that the odd year grid is offset by two miles to the north and by two miles to the east from the even year grid.

The flight lines are typically flown in a north/south or east/west orientation depending on the natural terrain characteristics that the survey flight is over.

Flights generally originate out of Olympia for the coastal and western Cascade Mountains. Wenatchee is used for the Eastern and North Cascades. Spokane and Omak are bases for North and Eastern Washington. A variety of other airports can be used such as Port Angeles, Vancouver, Hoquiam, Colville, Arlington and Everett depending on the location of needed survey areas

Survey flight altitudes:
The survey is typically flown at a survey altitude of 2000 to 2500 feet AGL. At this altitude aerial observers are able to see the insect and disease mortality signatures easily and yet still be able to see out at least two miles from the aircraft to observe and map the full extent of the survey grid.

Survey flight planning:
A full day of survey typically consists of two flight legs usually one in the morning and one in the afternoon. The typical length/duration of flights legs usually average 2 ½ to 3 hours with a break between the two legs to allow for refueling/ surveyor and pilot breaks.

Typical ideal survey time frame is from 9AM to 3PM due to sun angle/shadows/best lighting. Since survey occurs during Daylight Savings time the actual ideal survey time frame is 10AM to 4PM. This usually translates into a take-off time of 9AM-9:30AM, a lunch/refueling stop at 12:30PM and a landing at the end of the day at 4:30PM-5PM.

Weather conditions:
The General Overview aerial survey can be conducted in range of weather conditions with clear sunny days tending to be the preferred conditions. Overcast days are also acceptable as long as the cloud layer is not too thick to block the sunlight appreciable and that the cloud layer bases are high enough to fly the survey at 2500 feet AGL without any mountain obscuration. Overcast days, if they are bright enough, are good in the sense that the overcast cloud layer tends to eliminate any shadows and gives nice even lighting on the survey terrain. Lots of puffy cumulus clouds with sunbreaks tend to create less than ideal survey conditions as it creates bright sunny spots and deep shadows on the survey terrain which makes it more difficult for the aerial observers doing the sketch mapping to see the insect and disease mortality signatures.

Temperatures for the General Overview aerial survey typically are less than 90 degrees Fahrenheit (which translate into ISA+25 or less conditions). So temperature typically isn't a factor when doing the General Overview aerial survey unless the temperature gets above 95 to 100 degrees Fahrenheit. Typically all surveys are flown in ISA+20 or ISA+25 conditions or cooler. Typically it is best to avoid flying survey when it is ISA+30 or hotter temperatures as aircraft performance decreases.

Aircraft:
N357PN – WDFW turbo Partenavia (secondary aircraft used for survey through ODF agreement with WDFW. Aircraft can be used for survey though-out Washington).
N147Z – USFS Aero Commander (primary aircraft for survey in the Cascades where terrain is generally above 5000 feet in elevation. Aircraft can be used for survey through-out Washington).
Typical aircraft speed when flying survey using N357PN is 100 to 110 knots and when using N147Z is 120 knots.

Airports:
Olympia is the general base of operations for the coastal areas, as well as the western Cascade Mountains and southern Washington. Arlington or Everett are used for the NW Cascade Mountains. Wenatchee is used for the east side of the Cascades. Omak for Northern Washington and Spokane for Eastern Washington.

Other airports that have been used during the General Overview aerial survey include the following: Bellingham, Colville, Yakima, Port Angeles, Hoquiam, Arlington, and Everett.

Several other airports are often used for fuel, rest breaks, and lunch breaks including: Deer Park near Spokane, Astoria OR, Troutdale, OR, and Dallesport, WA.

An airport runway length of at least 2900 feet is the minimum preferred length for landing/takeoff when using N357PN. An airport runway length of at least 3500 feet is the minimum preferred length for landing/takeoff when using N147Z.

Dispatch offices and flight following:
Automated flight following (AFF) for the General Overview aerial survey can either be done with Federal or State dispatch offices and include the following:

For Federal Interagency the main dispatch offices to AFF with are Central Washington Interagency Dispatch Center, NE Washington Interagency Dispatch Center, Puget Sound Communication Center, and Columbia Cascade Interagency Dispatch Center. All of the above dispatch offices utilize the National Flight following (NFF) frequency.

A variety of other dispatch centers run by the Washington department of Natural Resources (WDNR) are also utilized. These are, Olympic Region, Northwest Region, Pacific Cascade and South Puget Sound. Olympic region DNR is used for the western part of the aerial survey.

Columbia Cascade ICC, Puget Sound and Central Washington are used for the west side of the Cascades.
Central Washington in Wenatchee is used for a great portion of the survey on the east side of the Cascades, Northern Washington and into NE Washington.

NE Washington Interagency CC located in Colville is used for flights in Eastern Washington.

The Federal Interagency dispatch offices also have and use a dispatcher Gmail account that all their dispatchers have access to so you can also email each of the dispatch offices a map of your intended flight plan for the day if you wish. Doing so tends to simplify the calls that you make to the dispatch offices in the morning to arrange for flight following.

One consideration with flight following during this time is that the survey usually occurs during fire season so a dispatch office may have limited resources available for doing flight following if they have a lot of fire activity going on in their dispatch zone. In those cases it may be possible to use another dispatch office that may not be as busy for your flight following needs.[326]

[326]Hof, Justin. 2016. General overview aerial survey, Washington aerial survey operations plan and reference guide. 11 p. R6 aerial survey program files. Sandy, OR.

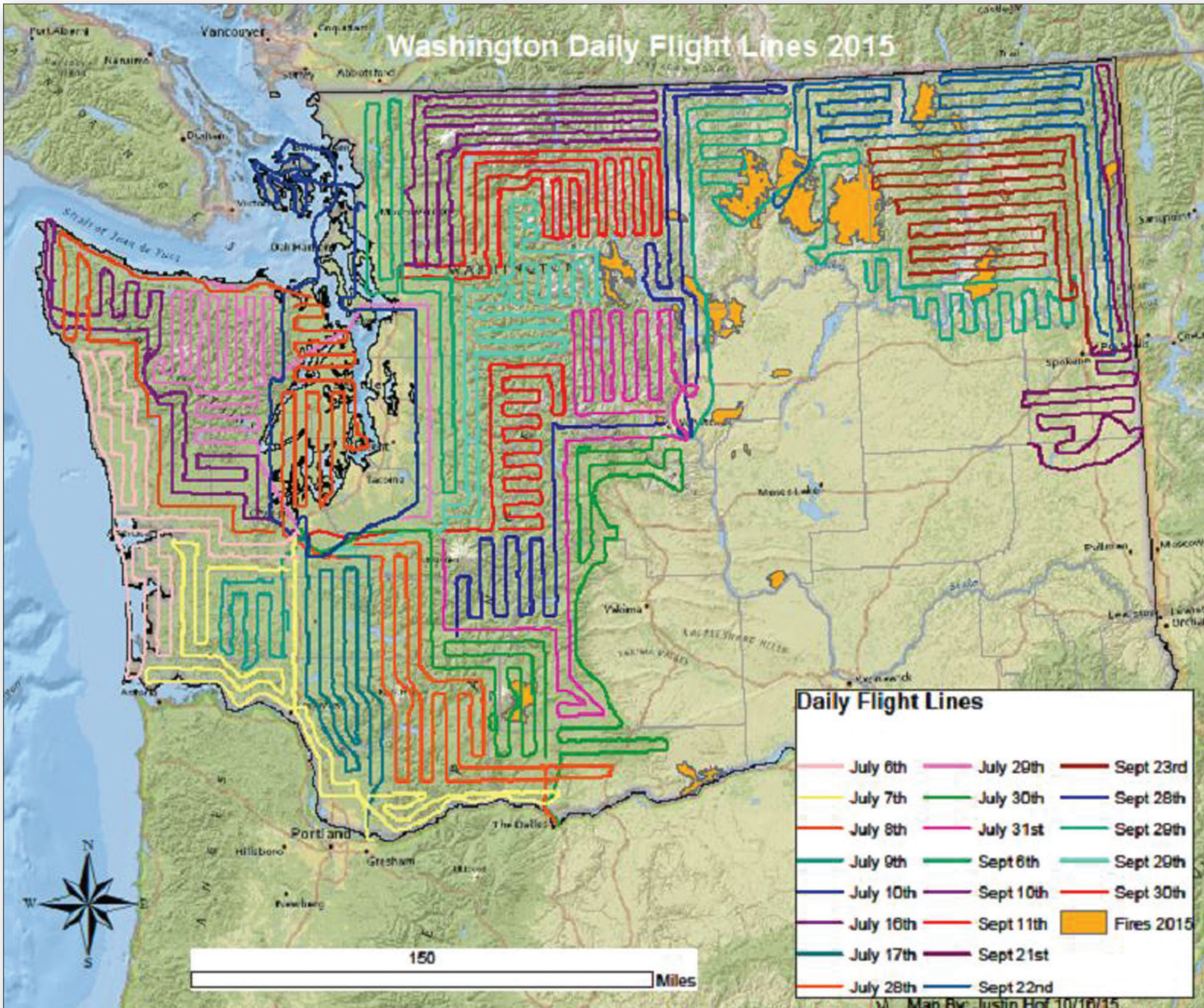
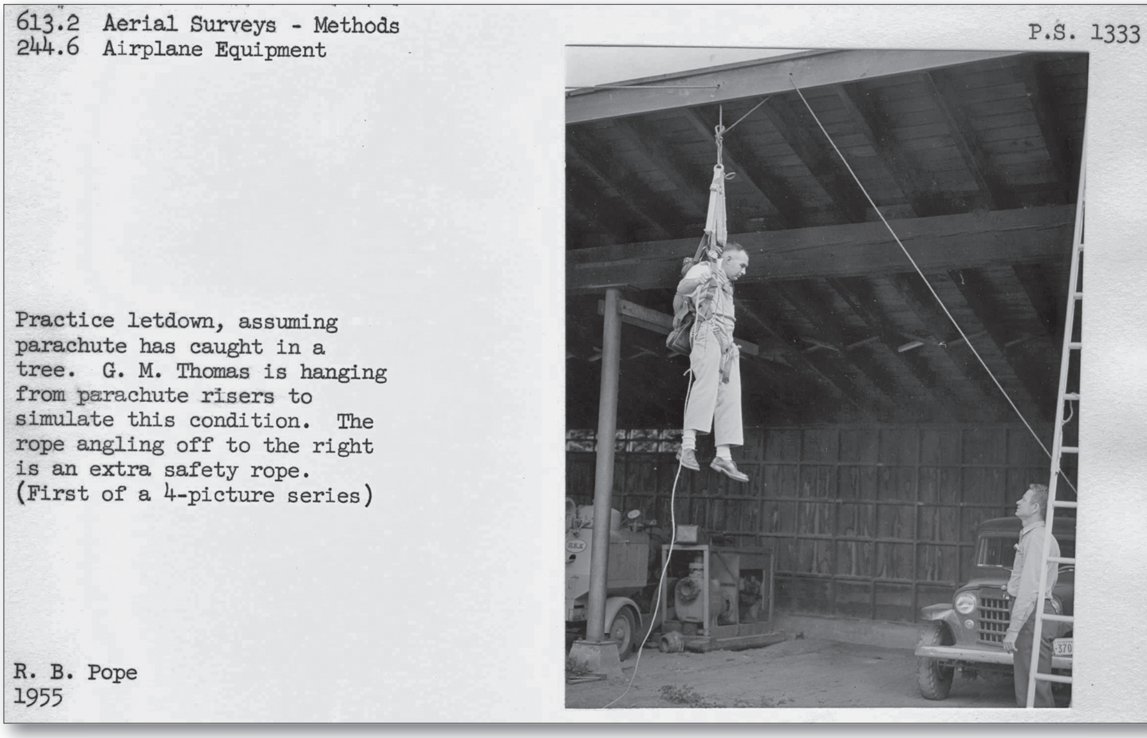


Figure A7. *Area covered by the Washington general overview survey in 2015. Map prepared by Justin Hof.*

5.2 Forest Health Protection aviation safety

This section highlights some aerial survey safety equipment, concerns, and policies through the years.



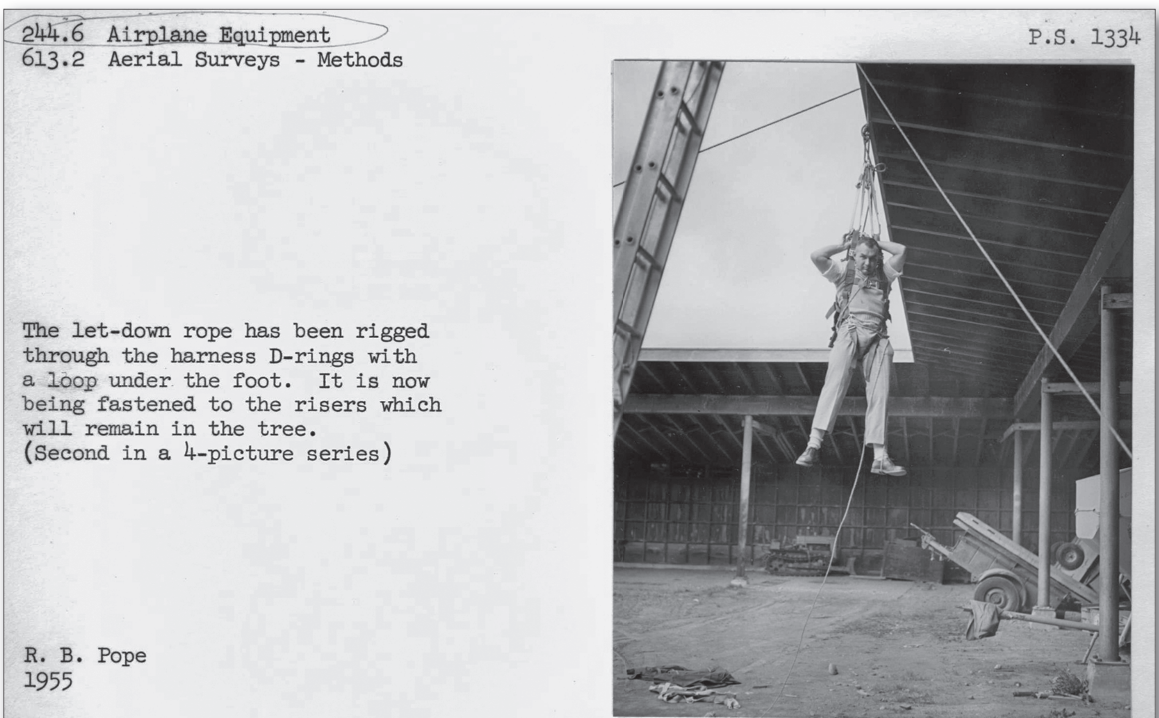
613.2 Aerial Surveys - Methods
244.6 Airplane Equipment

P.S. 1333

Practice letdown, assuming parachute has caught in a tree. G. M. Thomas is hanging from parachute risers to simulate this condition. The rope angling off to the right is an extra safety rope. (First of a 4-picture series)

R. B. Pope
1955

Figure A8a. *Practice letdown, assuming parachute has caught in a tree. G.M. Thomas is hanging from parachute risers to simulate this condition. The rope angling off to the right is an extra safety rope. Photo by R.B. Pope. 1955. USFS Portland Station Collection, PS-1333.*



244.6 Airplane Equipment
613.2 Aerial Surveys - Methods

P.S. 1334

The let-down rope has been rigged through the harness D-rings with a loop under the foot. It is now being fastened to the risers which will remain in the tree. (Second in a 4-picture series)

R. B. Pope
1955

Figure A8b. *The let-down rope has been rigged through the harness D-rings with a loop under the foot. It is now being fastened to the rises which will remain in the tree. 1955. Photo by R.B. Pope. USFS Portland Station Collection, PS-1334.*

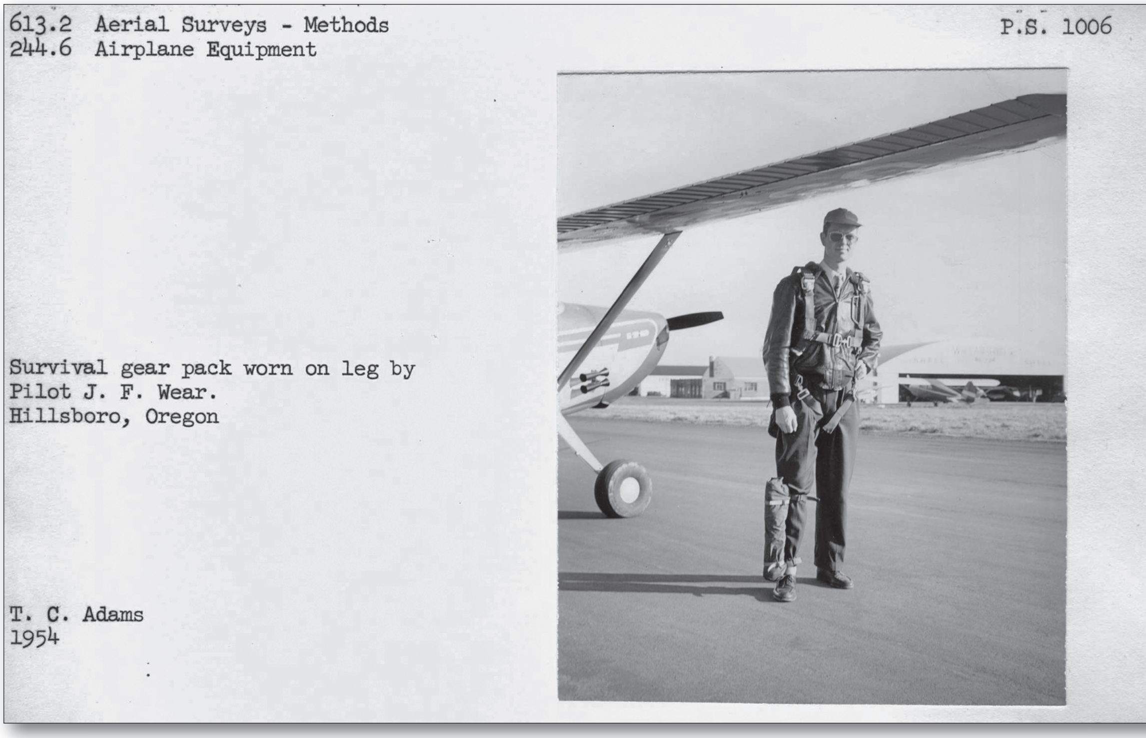


Figure A9. *Survival gear pack worn on leg by pilot J.F. Wear. Hillsboro, Oregon. 1954. Photo by T.C. Adams. USFS Portland Station Collection, PS-1006.*

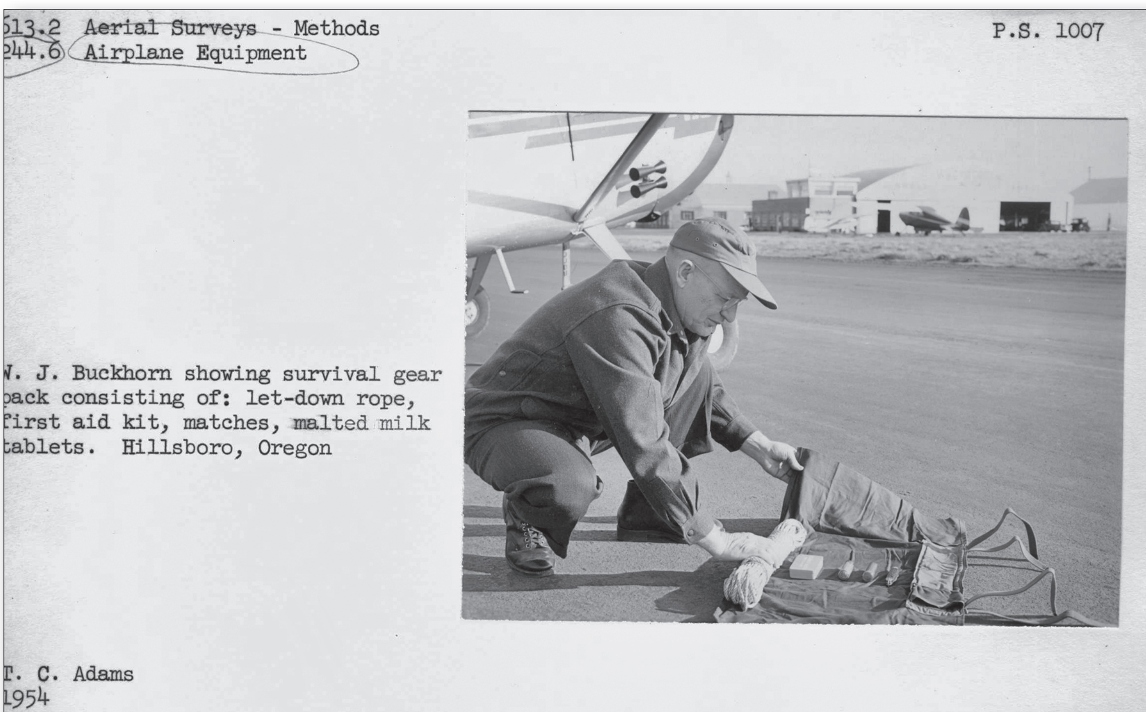


Figure A10. *W.J. Buckhorn showing survival gear pack consisting of: let-down rope, first aid kit, matches, malted milk tablets. Hillsboro, Oregon. 1954. Photo by T.C. Adams. USFS Portland Station Collection, PS-1007.*

Figure A11. *Amphibian Beaver and crew on the Porcupine River during the1992 interior Alaska aerial survey. From left, FS observer Bob Wolfe; pilot Mike Bowers; observer Roger Burnside, Alaska Department of Natural Resources; and forest entomologist Mal Furniss of Moscow, Idaho. Furniss was ground checking stem-killing of feltleaf willow by a bark beetle,* Trypophloeus striatulus, *which he was studying under contract with Forest Service Region 10. R10 safety measures included: Whenever entering the willow thickets, the mosquitoes were beyond belief. Every skin part had to be protected. Also, all FS Alaska field parties had to be accompanied by a person with a rifle, as here with Bob Wolfe. Photo and caption courtesy of Malcolm M. Furniss.*

1951-1954: Mal Furniss recalled early aerial survey safety in California (also in AK in 1992; see Figure A11):

> *The emphasis on safety was not evident through my short involvement as an observer in the Cessna 195 and then the Cessna 170B ca 1951-1954 at Berkeley. Wear used to come down from Portland to fly us on the Calif. surveys. My first ride was in the 195 out of Fall River Mills on the Lassen NF. I was given a parachute and told to put it on but I don't recall any fitting of the harness or instruction for using it. In following years, I don't remember there being a chute.*
>
> …
>
> *Also, we didn't have any means of being kept track of. We just had a weekly plan. The Bureau FII office was in Berkeley and they certainly had no means of radio communication. We had no ties with anyone involved with forest ownership over which we flew and we never communicated with anyone on the ground while flying although agencies involved knew of the survey being underway.*
>
> *As for training, we received none because nobody knew more than we did at the time. And as for selecting recruits; there were few of us and we did all the jobs that needed doing: Helping with research, doing aerial & ground surveys and rendering control supervision. Had I been screened for air sickness, I would have been sent to the shower first day.*[327]

[327]Personal communication with Malcolm Furniss, April 11, 2016.

1955: From Wear and Buckhorn's 1955, *Organization and conduct of forest insect aerial surveys in Oregon and Washington*:

Safety Precautions

Personnel engaged in forest insect surveys in the Northwest are exposed to hazardous flying because surveys are made close to the ground over high, mountainous, and timbered terrain. Every possible safety precaution is in compliance with the U.S. Forest Service Safety Code and the Air Operations Handbook is taken to prevent accidents.

The survey plane is carefully inspected before very flight; 25-hour periodic checks are made in addition to the regular checks by a licensed mechanic required by the Civil Aeronautics Administration. Log books are kept up to date and properly certificated. The plane is equipped with CAA-approved shoulder harness and seat belts capable of withstanding the shocks of a forced landing. It is equipped with a jettisonable door, fire extinguisher, first aid kit, hatchet, and emergency rations. All aircraft is painted in a high-visibility read and yellow for air safety and contrast to ground vegetation.

The useful load carried by the airplane is reduced at least 25 percent below capacity on forest insect surveys. This reduction improves landings and take-offs from small high-elevation airports. The reduction also reduces the hazards of low flying above the timber during the hottest and most turbulent part of the day, especially when operating at high elevations.

The planes used have slow landing speeds and can make safe landings in extremely small areas. In an emergency, a forced landing would generally be preferred to a jump when a field, road, or dense stand of young trees is available. Over tall timber a jump usually would be preferred because CAA records in the Northwest show that, regardless of the type or size of aircraft there is only a 5 percent chance of surviving a plane crash in tall timber.

The crew is equipped with the latest type, quick-opening back pack parachutes. These are worn at all times during flight. Because the plane frequently flies at minimum altitude, where seconds count in an emergency, the entire crew is thoroughly indoctrinated in "bail out" procedures. With practice on the ground, the plane can be abandoned in 20 seconds. Under actual conditions the full crew would be free floating in 25 seconds; the resulting loss in vertical distance during bail out would be approximately 250 feet. Parachute jumps are not recommended by the U.S. Forest Service below 800 feet.

Reliable radio communications are maintained for safe aerial operations. Position reports, weather information, and special reports are received and transmitted during all survey flights. Position reports are transmitted at least every 30 minutes to a CAA range station or other reliable radio facility.

Over relatively level terrain at survey altitude, VHF (high frequency) radio transmission is used because it is generally clear and free from static. VHF transmission, however, is line-of-sight and signals are frequently blocked by terrain. Therefore, low frequency radio transmission is used in mountainous terrain due to the arc of the radio's transmitted signal. The survey plane's low frequency radio is equipped with a trailing antennae to obtain maximum transmitting and receiving range. A communication network is mandatory for aerial surveys in the Northwest to maintain continual contact with survey aircraft. It should include the continued use of CAA low frequency and VHG units and a system of mobile or fixed receiving transmitting stations.[328]

1990: Tim McConnell worked with Bill Ciesla from 1989-1990 to get hazard pay re-approved for aerial surveyors in R6. After Bill Ciesla left for FAO in June of 1990, Iral Ragenovich pursued the issue as the acting Director. R6 FAM granted R6 surveyors flying in single engine planes hazard pay. FAM's decision is captured in these two letters:

Reply to: 5700
Approximate date: Fall 1990
Subject: Review of Hazard Pay
To: Iral Ragenovich, Acting Director Forest Pest Management
From: Theodore T. Heard, Fixed wing Program Manager

As requested, I have reviewed the letters from Tim McConnell (5/12/89), Bill Ciesla (7/12/89), and the excerpts of the "Pay administration, Attendance and Leave Handbook that you sent me.

[328]Wear, J.F.; Buckhorn, W.J. 1955. Organization and conduct of forest insect aerial surveys in Oregon and Washington. Portland, OR: USDA Forest Service, Pacific Northwest Forest and Range Experiment Station. p. 4.

It is my opinion that the sketchmappers who are involved in the annual aerial insect detection survey (AAIDS) flights, should be allowed to receive hazard duty pay while flying their detection flights in single engine airplanes. The reasons for this opinion are as follows:

The AAID survey program requires either a grid or, in the case of the most rugged terrain, a contour type of flight profile be flown to keep the sketchmappers properly oriented. This basically eliminates the possibility of planning the flight paths to have suitable emergency landing sites available.

Some of the terrain that these flights are required to traverse is such that if a single engine airplane were to have an engine failure, or even a partial power loss, at an altitude less than 2 to 3 thousand feet Above Ground Level (AGL), that it could not glide far enough for an off airport landing to be survivable.

At 500' to 1000' AGL, most of the area that is surveyed, would not offer much of a chance for the pilot of a single engine airplane to have successful emergency landing.

In reviewing the "pay Administration, Attendance, and Leave Handbook, it is my opinion that the sketchmappers meet the conditions of paragraph 12.92b (2) FLYING; B. "limited control flights". As an example of limited control flights, statement #2 states, "(2) Maneuvering single engine aircraft at low levels and low speeds for the purpose of wildfire and natural resource surveys over rough terrain in remote regions of the country. The hazard is possible engine failure or mechanical malfunction that would dictate emergency landing under the worst possible conditions: - - . In this application, I feel that any operation below 1,000' AGL in single engine airplanes should be considered to be low level.

THEADORE T. HEARD
Fixed wing Program Manager[329]

From: Earl Palmer
R-6 Asst. Director of Aviation
To: Iral Ragenovich
Acting Director of FPM
Date: August 16, 1990
Subject: Hazard Duty Pay
Reply to: 5700

In accordance with your request, we have reviewed the work conditions your sketch-mappers are subjected to while conducting the annual aerial insect detection (AAID) survey.

FSH 6109.11 (PAY ADMINISTRATION, ATTENDANCE AND LEAVE HANDBOOK) outlines conditions which authorize differential (hazard) pay.

Paragraph 12.92b 2.b. describes limited control flights: The grid pattern, used in relatively flat terrain, and contour flight patterns, used in mountainous terrain, by the AAID survey crews, in my opinion, meets the description of "limited control flights".

Single engine airplanes, versus multi-engine airplanes, have virtually no "fly away" capability following an engine failure. Glide distances are limited, a glide ratio of about 10:1 is optimistic. This means that an airplane flying at 500' AGL (Above Ground Level) will be able to travel a maximum distance of 5000 feet horizontally before contacting the surface. This limited distance severely restricts the availability of suitable forced landing areas. In fact, little of the area surveyed, since it is forested, will allow for a reasonable chance of landing an airplane without substantial damage to the aircraft and bodily injury to its occupants.

Flight patterns which would place single engine airplanes over or within gliding distance of a suitable forced landing area have been considered. This approach to the problem is not practical, and for much of the area to be flown, is not possible.

[329]R6 aerial survey program files. Sandy, OR.

Because of these factors, I believe your surveyors should receive hazard pay when flying in single engine airplanes during these surveys.

Signed: Earl Palmer
Assistant Director of Aviation
Region Six[330]

1996: Aerial Survey Working Group formed.

2000: Aerial Survey Working Group chartered.

2001: In 2001, Rob Mangold (FHP Director - WO) authorized hazard pay for all FHP aerial sketchmappers nationwide:

Date: October 11, 2001
File Code: 3400/5700
Subject: Hazard Pay for Aerial Sketch Map Surveyors
To: Forest Health Protection Staff Directors

As discussed with the Forest Health Protection Directors on our September 17, 2001, conference call, I support the consistent approval of Hazard Pay Differential for all employees conducting aerial sketch map surveys. Understanding the inherent risk involved with aerial survey work is very important. Hazardous duty is work performed under circumstances that could contribute to an accident resulting in serious injury or death.

*I consider aerial sketch map surveys to be "**limited control flights**" as defined in the Forest Service Handbook (FSH):*

WO Amendment 6109.11-92-1, effective 8/3/1992, provides direction under 12.92b – Duties Covered by Hazard Pay Differential.

*2. Flying. b. "**Limited control flights**" are flights that require unusual flight pattern, maneuvers, or formations that reduce the pilot's control of the aircraft and increase the risk of accident. Such flights do not include routine take-offs and landings. The nature and degree of hazard, and the control which may be exercised over the hazard, depend on the type of aircraft and its flight characteristics.*

Please note that the FSH distinguishes between "limited control flights" and "low-level flights." Aerial sketch map surveys are considered to be limited control flights, but not low-level flights. To be considered "low-level" a substantial part of the flight must be performed below 500 feet above ground level (AGL). All fixed-wing aerial sketch map surveys will be conducted above 500 feet AGL at all times, except take-offs and landings.

I encourage you to support all training necessary to insure that all aviation related activities are carried out safely by your employees and cooperators. Forest Health Protection (FHP) has an excellent safety history and we must do everything we can to maintain it.

Please contact FHP Aviation Safety Manager Tim McConnell at tmcconnell@fs.fed.us or 970-295-5878 if you need additional information.

/s/ ROBERT D. MANGOLD
ROBERT D. MANGOLD
Director, Forest Health Protection

cc:
Tim McConnell, FHTET-Fort Collins
Allan Bullard, FHTET-Morgantown
Andy Mason, FHTET-Fort Collins
FHP:A.Mason:lt:10/10/01:205-1600[331]

[330] R6 aerial survey program files. Sandy, OR.

[331] Ibid.

2010: *Aerial Survey Working Group Charter*:

The Working Group:

The Aerial Survey Working Group (ASWG) was formed in November of 1996 to provide field-level input to the FHP Washington Office and Staff Directors as well as to provide technical assistance to others conducting or planning to conduct aerial surveys. The group was formed to support the need for national aerial survey program leadership and direction. Functioning autonomously, as an ad hoc group of forest health and aviation specialists, the ASWG provides technical input to resource professionals regarding issues of aerial survey safety, efficiency, and effectiveness. The ASWG was originally chartered by Forest Health Protection in March of 2000. . . . FHP has the second largest aviation program in the Forest Service after firefighting. FHP and its cooperators fly approximately 4,000 hours each year and survey more than 400 million acres annually.

The ASWG has the following objectives:

1. *To promote a positive safety culture by applying components of Safety Management Systems, helping all aerial survey programs to operate in a safe and efficient manner.*
2. *To acquire high-quality aerial survey data resulting in accurate reports and maps of forest insect, disease, and related conditions on state, private, federal and tribal lands.*
3. *To provide input to the FHP Washington Office, Staff Directors, Fire and Aviation Management, State Foresters, and State Cooperators on aerial survey program issues and opportunities.*
4. *To broadly and cooperatively share expertise, information, and ideas.*
5. *To continue to improve the reliability and accuracy of the aerial survey program.*

Role of the national FHP Aviation Safety Manager position:

The National FHP Aviation Safety Manager is the permanent Chair of the ASWG and will provide advice and assistance to the national FHP Staff Director, Regional FHP Staff Directors, and State Foresters in meeting their aerial survey management and safety responsibilities. The FHP National Aviation Safety Manager also provides guidance and technical assistance to ASWG on aviation safety and aerial survey and serves as a coordinator for aerial survey training, certification, and standardization of FHP aerial surveyors. . . . The position also serves as a liaison between the ASWG, the FHP Management staff, and the National Fire and Aviation Management staff.[332]

2013: From the 2013 *Forest Health Protection Aviation Plan*:

CHAPTER V - SAFETY

A. Evaluations
Alternate methods that would accomplish mission objectives more safely and effectively will be of primary consideration. Concurrent hazard analysis and minute-by-minute risk management is everyone's responsibility throughout the project. The aerial hazard map depicts what has been surveyed at the site(s) and pilots will reconnoiter the area prior to descending to lower altitudes. Aerial observers will cancel or terminate operations when conditions are not within acceptable safety standards, or when a question exists regarding the safety of equipment or its' application (29CFR1960.46).

B. Protective Clothing/Equipment
Headsets will be worn by crew members on fixed-wing flights. Helicopter operations require PPE in accordance with IHOG.

When special projects involving hazardous chemicals are planned, a list of poison control centers, local physicians, and local emergency medical treatment facilities should be included. These local medical facilities should also be alerted as to the spray project. Hazardous materials will be handled in accordance within guidelines established in the "Interagency Aviation Transport of Hazardous Materials" guide at: https://www.doi.gov/sites/doi.opengov.ibmcloud.com/files/uploads/HAZMAT_Handbook_2005.pdf

[332] R6 aerial survey program files. Sandy, OR.

C. Load & Performance Calculations

Load calculations and weight and balance limits will be confirmed during the pre-project briefing. The pilot is responsible for overseeing the proper loading of the aircraft. Performance calculations will be documented for all flights conducted on aircraft operating under Special Approval when federal observers are participating; see Exhibit F-3 for performance calculation worksheet and examples of performance planning charts.

D. Aerial Hazard Maps

Current Aviation Sectionals will be maintained and reviewed for flight hazards. Pilots should alert the flight crew when in the vicinity of Military Training Routes and of the direction they may expect to see conflicting traffic. Hazard maps for Oregon and Washington can be downloaded from the NW Portal website at: http://www.nwportal.fs.usda.gov/

E. Aircraft Emergency Response Plan

National Forest and State agencies maintain Aircraft Crash, Search and Rescue plans. Agencies providing flight following will be responsible for activating the appropriate agency resources. (This is the primary reason that the affected units need notification of flight activity so that they will monitor the AFF screen.) In the event of an injury or fatality, the FHPAO, Aerial Survey Coordinator, or appropriate project manager listed in the enclosed FHP directory will notify family members. The person providing flight following will be responsible for having a copy of this aviation plan and notifying the appropriate individuals listed above.

F. Incident/Hazard/Maintenance Deficiency Reporting

Incident/Hazard/Maintenance Deficiency Reporting will be in accordance with the R6 Aviation Accident Prevention Plan and FSM 5720. Aviation incidents, specifically, shall be filed on Forest Service SAFECOM form 5700-14 within 24 hours of the incident. If a serious potential for an aircraft accident was involved, an immediate telephone report should be made to the RASM, or the appropriate program officer (helicopter or fixed-wing) at the Regional Aviation Group.

G. Training

Training will, as a minimum, be in accordance with those outlined in applicable Forest Service Manual and Handbooks. Specifically, employees who participate in special use flight activities or function as flight crew members shall receive annually the following:

1. *Review the prior year's national Accident and Mishap information.*
2. *Review the Aviation Plan*
3. *Review Risk Assessment and Standard Aviation orders.*
4. *Complete IAT recurrence requirements*

In addition to the above requirements, at least one member of the air crew will have received training equivalent to that listed for fixed-wing flight manager – special use, as listed in Interagency Aviation Training (IAT) (for current qualified position, see parenthetical remarks in directory). Other participants on a mission flight shall have completed the training listed for Air Crewmembers in IAT. Currently, the Forest Health Protection sponsored Aerial Survey Aviation Safety and Management course satisfies these requirements. Currency on this AS2M training is recommended every three years or as per IAT for the course recurrence criteria. The FHPAO shall keep track of qualified observers training accomplishments and requirements and will meet the training requirements listed in IAT for Unit Aviation Manager. The FHP group leader shall meet the training requirement listed for Agency Administrator.

Agreements between Cooperators and the Forest Service are reviewed annually prior to June first. Aerial observers must meet the requirements to function as fixed-wing flight managers-special use. Cooperating agencies will ensure that their employees meet these minimum aviation safety-training requirements.

When operating exclusive use contract aircraft at least one air crewmember will be designated as Contracting Officer's Representative or Project Inspector.

To function as a sketchmapper, individuals must also meet the following minimum qualification criteria:

A desire to participate in aerial survey activities.
An interest in aviation.
Good eyesight with normal color vision and depth perception.
Ability to endure riding in an aircraft for 3 to 6 hours a day without experiencing the debilitating effects of motion sickness.
Completed the task book for "Fixed-Wing Flight Manager - Special Use Forest Health Protection Aerial Observer" (Copy available upon request). Observers employed prior to 2002 are exempt from the task book requirement.

At the discretion of the senior observer, the apprentice will be evaluated on the above criteria. Satisfactory performance will be evaluated/determined by both State and Federal Program managers, and when in agreement as to the proficiency of the apprentice, a certification issued.

In addition to Aviation Safety currency requirements, sketchmappers will attend at a minimum, biennially, the annual Calibration and Conformity session which will focus on current safety issues and sketchmapping warm-up exercises.[333]

Additional safety and protective equipment

Oxygen: During high altitude flights a survey pilot is required to use oxygen to stay alert and functional; aerial surveyors use oxygen for the same purposes.

14 CFR § 135.89 Pilot requirements: Use of oxygen.

(a) Unpressurized aircraft. Each pilot of an unpressurized aircraft shall use oxygen continuously when flying—

(1) At altitudes above 10,000 feet through 12,000 feet mean sea level (MSL) for that part of the flight at those altitudes that is of more than 30 minutes duration; and
(2) Above 12,000 feet MSL.

Hearing protection: The Forest Service Safety Handbook (FSH) 6709.12 – Safety and Health Program Handbook includes a chapter on the Hearing Conservation Program (Chapter 23):

The Forest Service hearing conservation program is designed to protect employees from noise exposure that cannot be diminished or eliminated through engineering or administrative controls. The program consists of noise hazard evaluation, training, hearing tests, hearing protection, and recordkeeping. Employees exposed to hazardous levels of workplace noise, including those in noise hazardous occupations (sec. 23.12), must be included in a hearing conservation program. They shall receive baseline audiograms, annual audiograms, and be trained to wear hearing protection.

Aerial Observers are included in Chapter 23.12's Noise Hazardous Occupations. Noise from small aircraft engines can contribute to hearing loss; to reduce exposure, surveyors use noise-attenuating headsets and get annual hearing tests to monitor hearing loss through time.

[333]USFS; ODF; WDNR. 2013. 2013 PNW Forest Health Protection aviation plan. 20 p. R6 aerial survey program files. Sandy, OR.

5.3 Forest Health Protection safety training

Aerial survey aviation safety and management training (AS2M)

1996: In 1996, in conjunction with the establishment of the Aerial Survey Working Group, the first AS2M training session for Forest Health aerial observers was held in Golden, CO. This training is now required for aerial observers once every three years. The 2015 stated objectives:

> *Combined with on-line prerequisites, AS2M provides all necessary coursework to qualify students for "Fixed-Wing Flight Manager – Special Use". It is designed specifically for resource specialists who manage aircraft to safely conduct missions including aerial sketch mapping, photo/remote sensing, wildlife and vegetation surveys, and aerial reconnaissance in general.*
>
> *Course Subjects:*
>
> *1) Aviation safety and Management*
> *2) Conducting a Mission*
> *3) Aviation Administration and Policy*
>
> *IAT-approved courses: A-200 Mishap Review; A-205/305 Risk Management I & II; A-302 Personal Responsibility and Liability; A-303 Human Factors in Aviation; A-307 Aviation Policy and Regulations; and A-310 Overview of Crew Resource management.*
>
> *FHP-specific curriculum: Accident and Incident Review; Flight Plans/Following and Dispatch Operations; Selecting the Right Aircraft; Aircraft Instrumentation; Meteorology and Flying Weather; Mountain and Canyon Flying; Airspace Coordination; Federal Aviation Regulations and Operations.*

2001: Through the efforts of national FHP and FAM personnel, a *Fixed-Wing Flight Manager – Special Use Forest Health Protection Aerial Observer* position task book (PTB) was created for federal aerial sketch mappers in 2001. This training was designed specifically to meet the needs of other resource type flights (i.e. non-fire).

> *In the Forest Service all aircraft users, other than point-to-point use, are required to complete training and a set of on the job experiences. The National Interagency Incident Management System (NIIMS) Coordinating Group insures personnel are qualified for various aviation positions through the use of both formal training and the task book system. Forest Health*
>
> *Protection (FHP) feels that this system is a valuable method to insure FHP personnel are qualified to conduct safe, quality aerial sketchmap surveys and aerial photography missions. Though typically not required of state personnel and certain other federal cooperators, the PTB is recommended as a training tool to these entities.*
>
> ...
>
> **Interagency Aviation Training Definition:** *Government representative who works jointly with the pilot-in-command and air crewmembers to ensure safe, efficient flight management of missions other than point-to-point flying, i.e., reconnaissance, infrared, aerial photo, and other missions requiring special training and/or equipment.*
>
> **Additional FHP Information:** *The FHP Aerial Observer conducts aerial sketchmap surveys, aerial photography or videography. The intent is to provide a task book of requirements for a FHP aerial sketchmap observer.334*

Additional training:

> **Calibration and Conformity:** *Conducted every year by surveyors for surveyors to re-calibrate themselves to survey conditions before the season begins. Provides an opportunity to provide mandatory training, safety briefings, and update current forest conditions awareness. This course is usually conducted in June prior to the start of the general overview survey.*

[334] Forest Health Protection Fixed-Wing Manager – Special Use Aerial Survey Observer Position Task Book. Available online: http://www.fs.fed.us/foresthealth/aviation/resources/docs/FWFMSU_TaskBook_March2010.pdf Accessed 4/8/2016.

Pinch hitter: *Flight training taken by individuals as time and funding are available. This course covers the ability to fly and land an airplane during emergency situations where the pilot is incapacitated during a flight. The training usually takes place with an instructor pilot from the USFS RAG or a flight school.*

SLAM: *Safety Leadership in Aviation Management – University of CA in Davis – 3 week-long training sessions in Aviation Safety, Program Management, and Accident Investigation.*

A-314 Aviation Program Overview for FS Agency Administrators: *A synopsis of aviation policy, safety and accident prevention, training and qualification requirements of employees, liability, procurement, and aviation organizations as they relate to line officer responsibilities. Recommended every 3 years.*

Wilderness Survival, first aid, and first responder: *These courses are encouraged, but not required; scheduling is time- and funding-dependent.*

Appendix 6
Sellwood laboratory

The historic Portland Railway, Light, and Power, Sellwood Division Carman's Clubhouse (referred to in this report as Sellwood or the Sellwood Laboratory) building and outdoor space functioned as an insect laboratory, insectary, photo lab, shop, storage, and vehicle maintenance space by USFS entomologists and surveyors from about 1953-1984. It continued as a storage space until 1993. During the early years of the aerial survey, this space was used extensively for many survey-related activities.

This history is taken from a National Register of Historic Places registration form:

Portland Railway, Light, and Power, Sellwood Division Carbarn office and Carmen's Clubhouse

The Carmen's Clubhouse, built in 1910, is significant . . . for its association with the development of the Sellwood neighborhood in Portland and the rise and fall of the electric interurban railway system in Portland. The clubhouse was part of a complex that also included carbarns and a power plant created at approximately the same time. The development occurred at the highpoint of the "golden age" of the electric street railways and interurbans in the Portland area. In 1938, dwindling ridership forced the closure of the clubhouse …

As train service declined, the Sellwood facilities were sold off. In 1939 the U.S. Forest Service took over the clubhouse for use by the Civilian Conservation Corps. Both the clubhouse and car barns were purchased by the agency in 1942. Until it was vacated in 1984, the clubhouse functioned as a forest pest [laboratory] and as a storage site for construction and maintenance operations. Over time a number of other buildings were added to the lot, including a u-shaped covered carport (c. 1947; upgraded 1971) and wood-frame workshop. The property was used for storage by the Forest Service until 1993. In August 1996 the Forest Service sold the property with a protective covenant, ensuring the clubhouse's continuance as an historic resource.[335]

[335]US Department of Interior, National Park Service, National Register of Historic Places registration form, April 29, 2002.

Figure A12. *Sellwood Laboratory located at 8825 SE 11th, Portland, Oregon. August 1957. Photo by Ken H. Wright. USFS Portland Station Collection, PS-1725.*

Figure A12a. *Sellwood Laboratory. April 1964. Photo by David McComb. USFS R6 FHP Collection.*

244.1 Laboratory Equipment P.S. 1724

Insectary at Sellwood Laboratory
8825 S.E. 11th Ave.
Portland. 1953 -

K. H. Wright
August, 1957

Figure A13. *Insectary at Sellwood Laboratory 8825 S.E. 11th Ave. Portland, Oregon. August 1957. Photo by K.H. Wright. USFS Portland Station Collection, PS-1724.*

244.5 Photographic Equipment P.S. 1091

Print processing darkroom
at Sellwood Lab., Portland, Ore.

R.B. Pope
1956

Figure A14. *Print-processing darkroom at Sellwood Lab., Portland, Oregon. 1956. Photo by R.B. Pope. USFS Portland Station Collection, PS-1091.*

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16400 Champion Way
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Durham, NC 22701
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